Revised July 7, 2008

2008 MOURNING DOVE POPULATION AND RESEARCH STATUS REPORT

John H. Schulz
Resource Scientist
and
Ronald A. Reitz
Resource Scientist

2007 MOURNING DOVE HARVESTS

Missouri's Small Game Post-season Harvest Survey

Harvest data for Missouri during 2007 showed 40,955 mourning dove hunters harvested 734,568 doves statewide; a 0.7% decrease in hunters and an 11.9% decrease in harvest from 2006. The estimated 2007 dove harvest decreased 1.5% from the 5-year average (2002-06) (745,703 average harvest; SD 49,030) and decreased 0.8% from the 10-year average (1997-06) (740,678 average harvest; SD 38,786). Statewide, dove hunters averaged 4.1 doves per day and 4.4 days of hunting per season in 2007 compared to 3.9 doves per day and 4.7 days per season in 2006. Average season bag for 2007 was 18.0 mourning doves compared to 18.4 in 2006. Data for 2007, by zoogeographic region, showed Northeastern Riverbreaks and Mississippi Lowlands with the largest harvests (184,778 and 123,128 doves respectively) and Northern Riverbreaks the lowest (18,123 doves; Figure 1a).

Although dove harvest and number of hunters decreased slightly last year, long-term trends of harvest and hunters continue to show relatively long-term declines (Figure 3), with daily bag and average days afield increasing slightly the last few years (Figure 4). Although the number of hunters and harvested doves has declined since the 1970s, remaining dove hunters are hunting about the same number days, while gradually increasing their daily harvest.

Migratory Bird Harvest Information Program (HIP)

In addition to post-season mail harvest surveys conducted by individual states, the migratory bird harvest information program (HIP) was developed to fill the need for reliable harvest data to help guide management decisions for migratory game birds. Although federal waterfowl harvest surveys had existed since 1952, the historical surveys lacked a reliable sampling frame of names and addresses of all migratory bird hunters and, therefore, did not adequately address webless migratory game birds (e.g., mourning doves, woodcock). Since 1998, the HIP harvest survey has provided reliable estimates of hunter activity and harvest at national and regional scales for all migratory game bird species, and provides harvest estimates at the state scale that are comparable among states.

During the 2007 season, as estimated by the HIP survey, Texas led the Central Management Unit (CMU; Figure 2) in mourning dove harvest with 5.46 million birds killed by 275,200 dove hunters (Table 1). During 2007, Missouri was fourth in mourning dove harvest with 603,300 doves killed by 42,600 dove hunters; Arkansas was second, Kansas was third, and Oklahoma was fifth in harvest (Table 1).

2008 MOURNING DOVE POPULATIONS TRENDS/SURVEYS

The Department annually conducts two dove surveys in Missouri, the National Mourning Dove Call-Count Survey (CCS) and the Roadside Dove Survey (RDS). The CCS is a national survey conducted annually in cooperation with the states and the USFWS. The CCS was established in 1966, and currently surveys ≥1,000 roadside routes nationally. The CCS was established to provide regional and national population indices. In Missouri, the CCS provides an index of doves heard calling per mile along 20 standard routes. In addition to the CCS, the RDS is an independent survey conducted annually by Department staff; the survey contains usable data going back to 1948. The RDS provides an index of doves seen, rather than calling, along standardized routes throughout the state (some urban counties have been excluded because of traffic concerns). The RDS provides regional data for Missouri that the CCS cannot supply. There is very strong long-term relationship between both surveys over several decades; however, it is not unusual for the two surveys to show opposite trends within a given year.

National Mourning Dove Call-Count Survey

For Missouri, CCS linear route regression analysis between 2007 and 2008 showed a significant ($P < 0.01$) decrease of 27.4% (90% CI: -35.32% to -19.5%; Figure 5). During the last 10-years (1999-08), Missouri's CCS trend data showed a nonsignificant ($P > 0.10$) increase of 0.4% (90% CI: -1.4% to 2.3%) per year. Long-term trends from Missouri's CCS data continued to show a significant ($P < 0.10$) decline of 1.8% (90% CI: -3.7% to 0.1%) per year from 1966-2008. Throughout the 14 Central Management Unit (CMU; Figure 2) states, 2008 dove populations showed a significant ($P < 0.01$) decrease of 8.5% (90% CI: -14.0% to -3.0%) compared to 2007 population indices. Surprisingly, the moving 10-year average trend in doves heard along CCS routes in the CMU showed the lowest levels since the estimated 1979–1988 trend (Figure 6a). However, the relative trend of doves heard calling and doves seen while conducting CCS routes in the CMU show completely different trajectories lending suspicion to the value of the data in a harvest management decision-making process (Figure 6b).

Missouri's Roadside Mourning Dove Survey

Statewide results of the 2008 RDS showed 1.28 doves/mile; an 8.97% decrease compared to 2007 (Figure 5), an 8.94% decrease from the statewide 5-year average (2003-07; 1.41 doves/mile, SD 0.13), and a 6.43% decrease from the statewide 10-year average (1997-06; 1.37 doves/mile, SD 0.13; Table 2). By zoogeographical regions (Figure 1a), Mississippi Lowlands had the highest index (2.49 doves/mile) and the Northern Riverbreaks and Ozark Plateau the lowest (0.94 and 0.95 doves/mile respectively; Table 2a). By Department management regions (Figure 1b), Central, Kansas City, and Southeast Regions had the highest indices (1.56, 1.52, and 1.52 doves/mile respectively) and Ozark Region the lowest (0.63 doves/mile; Table 2b).

This year, both the CCS index and RDS index showed decreases from the previous years as well as declines in 5-year and 10-year averages (Figure 5), indicating stable to slightly lower population levels. Depending upon weather conditions the last week of August and early September and food availability to concentrate doves, hunting opportunities are anticipated to be good to slightly below average.

Long-Term Population Trends

Long-term mourning dove trends from both RDS and CCS surveys provide an interesting picture (Figure 5). Since 1966, both surveys show a strong relationship to each other (r = 0.73; 1966-2007). If we assume that these 2 surveys are tracking similar aspects of the mourning dove population, we see 3 things emerging from Figure 5. First, we see that although trends have declined since 1966, the trend has been relatively stable in the last 10 years. Second, we see that although trends are lower today than during the late 1960s, RDS trends are near levels similar to the late 1940s and early 1950s. Third, we see that some phenomena occurred during the late 1950s and early 1960s that caused trends to climb rapidly. Regionally, we can speculate that some beneficial and broad scale land use changes occurred in the Mississippi Lowlands, Northeast Riverbreaks, Northeastern Riverbreaks, and Western Prairie during the late 1950s and early 1960s (Figures 10–17). Regardless, the important point is that roadside trends are problematic at best when trends of similar variables contradict each other (Figure 6b).

From a national perspective, some controversy exists about the relative merits of the North American Breeding Bird Survey (BBS) and CCS surveys, and the actual ability of the surveys to track real changes in mourning dove population trends. Although the CCS protocol is specifically designed for doves, the number of survey routes is less compared to the BBS, which leads to concerns about the sensitivity of the survey to detect trends. In addition, these trend declines may not be indicative of actual changes in populations, but rather an index to unmated males in the breeding population, changes in habitat along standardized survey routes, or a wide range of other factors. Although uncertain in some respects, these data provide a useful and generalized picture of relative population trends for use in providing hunting forecast, etc. These uncertain data, however, show the need for improving the reliability of the information used in the harvest management decision making process (i.e., establishing and changing hunting regulations). This was the primary motivation for the establishment and approval of the Mourning Dove National Harvest Management Plan adopted by all flyway councils and the International Association of Fish and Wildlife Agencies, and the emerging and ongoing national mourning dove banding and wing collection programs.

INTERIM MOURNING DOVE HARVEST MANAGEMENT STRATEGY FOR THE CENTRAL MANAGEMENT UNIT AND IMPACTS ON THE 2009 MOURNING DOVE HUNTING SEASON REGULATIONS

As mentioned above, the future of dove management depends primarily upon harvest management and our understanding of how harvest affects dove populations. In other words, our primary explicit assumption is that doves are habitat generalists and that we believe changes at the macro-habitat level has minimal impact on abundance. Increasingly, there has been broad-scale support for improving the information used in the decision making process for mourning dove harvest management. In 2001, a National Mourning Dove Planning Committee was formed and developed a plan of action that would lead to guidelines that technical committees could use to prepare harvest management plans for their respective management units. The National Plan was approved by all 4 flyway councils in August, 2003. The plan outlined a new vision of information-based decision making compared to the status quo of singly relying on population trends from roadside indices. The USFWS Regulations Committee (SRC), however, requested the respective management unit technical committees develop an interim mourning dove harvest management strategy given available information (e.g., CCS indices). This request was based upon a perceived idea that the recently approved National Plan, although a step in the right direction, would not provide useful assistance in the harvest regulation process for several years.

The revised harvest management strategy provides guidelines for cooperative establishment of mourning dove hunting regulations in the Central Management Unit (CMU; Figure 2). This revised strategy is a transitional step towards implementation of the strategy envisioned in the **Mourning Dove National Strategic Harvest Management Plan**, and provides recourse in the event of large changes in the mourning dove population. The composite trend models used as the basis of the strategy will be replaced by population models in ≤ 5-years, pending continued and expanded support for banding and wing survey programs, and research generating information for population models. This interim strategy, and subsequent strategies using population models, will fulfill requests by the USFWS for mourning dove harvest management strategies that use similar sources of data among dove management units.

The interim strategy presumes that regulatory decisions will be made based solely on composite population trends during a specified time frame. The composite trends will be estimated from four data streams: CCS-heard, CCS-seen, BBS, and population growth rates derived from banding data. It is assumed that there are 3 regulatory alternatives, which are generically referred to as: 1) restrictive, 2) enhanced, and 3) standard. The simple idea is that if the composite trend is at or below some pre-determined lower threshold value with some specified level of statistical confidence, then regulations would be restricted. If the trend is at or above an upper threshold value with some specified level of statistical confidence, then regulations are liberalized. Current regulations will be maintained as moderate or standard packages if the trend is between the 2 thresholds. It is important to note that while these composite trends provide a decision making framework in the **interim**, they are largely uninformative to processes governing dove populations. That is, the composite trend indices do not inform managers as to why the trend goes up or down, or the effects that harvest regulations have on population vital rates.

The first step in developing composite trends was to generate adjusted annual indices for each state by using Bayesian hierarchical modeling to adjust route counts for observer and year effects, missing data and statistical distribution violations. Each of the 3 surveys is modeled independently, and analyses have been completed for all surveys and states. The indirect population estimates derived from banding data are assumed to be unbiased and are not adjusted. Next, a second hierarchical analysis was performed that used all 4 data sources to produce a composite abundance estimate for the management unit (set on a log scale) and an associated credibility interval for each year.

Implementation of a decision framework requires specification of 6 parameters:

- time interval to generate indices,
- annual rate of change during the selected time interval that will trigger a liberalized harvest regulation (L),
- probability (P_L) that the trend estimate (T) is equal to or greater than L in the posterior probability distribution,
- annual rate of change during the selected time period that will trigger a restricted harvest regulation (R),
- probability (P_R) that the trend estimate (T) is less than or equal to R in the posterior probability distribution, and
- the number of years the regulatory package remains in place.

These criteria provide the flexibility to implement a wide spectrum of regulatory options accommodating a wide range of considerations. Following is a matrix showing the decision outcomes in the harvest regulation decision-making process. Simply stated, if the composite 5-year trend is significantly increasing we can anticipate a 22-bird daily bag with a 70-day season. If the trend is stable we would likely have a 15-bird daily bag with 70-days. If the trend is declining we would have an 8-bird daily bag. Regulations remain in effect for 3-years if a change occurs to evaluate impacts of the change; data analysis of trends occurs annually. Using data from 1980–2006 to determine if regulatory changes would have occurred in the past, we found that no regulation changes would have occurred based on a historical look at the performance of composite trends. Thus, we can likely expect a 15-bird daily bag and with 70-days of hunting in fall of 2009.

Composite Population Trend	Estimated annual rate of change during a 5-yr interval	Proportion of Estimated Trend	CMU Daily Bag Limit
$t > 0.00$ (increasing trend	$\hat{t}_L > 0.05$	$P_L \geq 0.80$	22 (**enhanced**: 47% increase in bag limit, and an estimated 24% harvest increase)
$t = 0.00$ (stable trend)	$\hat{t}$ is between -0.05 and 0.05	--	15 (**standard**: no change in bag limit)
$t < 0.00$ (declining trend)	$\hat{t}_R < 0.05$	$P_R \geq 0.80$	8 (**restrictive**: 47% reduction in bag limit, and an estimated 24% harvest reduction

MONITORING DOVE SHOOTING FIELD MANAGEMENT

Mourning doves can provide abundant hunting opportunities close to where urban residents live. Unlike other game animals that require relatively large areas of habitat management for hunting, dove shooting field management can routinely occur on sunflower fields ranging in size from 5–30 acres. However, considerable uncertainty exists concerning mourning dove harvest management strategies; e.g., half day vs. all day hunting, large daily harvests in relatively short periods vs. small daily harvests spread out over a longer interval.

To address this range of management questions, biologists from several conservation areas with active dove shooting management programs met in July, 1999 to develop a long-term Adaptive Resource Management (ARM) process; the program was expanded to include additional areas in 2003. The ARM process works best with management problems such as this one because the problem is small enough to explicitly define, and develop a meaningful and efficient monitoring program. Thus, the overall goal of the ARM program is learn how different dove management strategies impact our objective of maximizing dove hunting opportunities on public areas. To monitor our success in meeting our objective, we are collecting information on various harvest related metrics (Table 3, 4, and 5). For example, 77.5% of dove hunters went hunting once during September 2007, 16.5% went twice, and 3.5% went three times (Table 5). As a part of the monitoring program, dove hunters on these areas are required to report the number of doves killed, shots fired, hours hunted, zip code (to obtain distance traveled to hunt), and number of doves shot but not retrieved.

Data obtained during 2007 showed many dove hunters likely enjoyed the opportunity to see and shoot at numerous doves regardless of their ability to actually harvest and take home some birds (Figure 7); i.e., the largest proportion of hunters reported shooting no doves. Also, most dove hunters spent ≤3 hours hunting (Figure 8), and traveled a median distance of 3.5 – 50.3 miles to hunt doves (Figure 9). Similar to last fall, an orange-colored daily hunting card will be mandatory for dove hunters on these selected areas to help collect the necessary information to meet the objectives of this monitoring program.

It is important to note that the few areas involved in this long-term monitoring program represent just a few of the numerous mourning dove hunting opportunities on public areas found in Missouri. The Department provides managed mourning dove hunting opportunities on approximately 5,000 acres located on 150 fields located on over 90 public conservation areas scattered around the state. Check the public web sometime after the middle of August to locate the managed areas near you (http://www.mdc.mo.gov/).

MOURNING DOVE RESEARCH UPDATE

National Pilot Banding Study

To improve future harvest management decisions at the national, regional, and statewide levels, population information is needed to make better informed decisions. Revised harvest management strategies are being constructed using existing historical data to help make more informed harvest management decisions. Also, the national mourning dove banding program continues in an effort to obtain modern information on band reporting rates and harvest rates for use in the population models, which in turn will be used in making decisions about future changes in hunting regulations. To date, these efforts have received widespread support (e.g., flyway technical committees, flyway councils, joint flyway councils, and the AFWA subcommittees and its working groups). Missouri is banding doves on 15 areas, and attaching bands to almost 2,500 birds annually.

Hunters that shoot and retrieve banded birds are asked to call **1-800-327-BAND (2263)** or report the band online (http://www.reportband.gov/). Hunters will be asked by the operator to provide the band number, the location where the bird was killed, and the date when the bird was killed. By reporting band numbers dove hunters will be helping to manage our dove resource for future generations.

Wing Survey and Recruitment

The National Dove Plan recognizes the need for mourning dove recruitment information. Recruitment indices for other migratory game birds are obtained from wing collections conducted by mail survey. However, annual printing and postage costs for these surveys are high. Collecting mourning dove wings from check stations at managed hunting areas is an alternative, less expensive way to collect large samples of wings. The samples from these areas, however, would have less extensive geographic distribution than a sample derived from a traditional mail wing survey. Thus, check station samples may not be as representative as samples from a mail survey. A 3-year study, therefore, was initiated in 2007 to collect samples of wings using the 2 different collection methods, compare state-level and management unit-level estimates of age ratios derived from the 2 methods, and provide a cost comparison. The results of this project will enable us to determine the most cost-effective way to conduct an annual operational mourning dove wing collection survey that will provide valid indices of recruitment at the desired geographic scale.

This project will also help us determine appropriate sample sizes for the survey. Other research is underway to calibrate these indices to actual estimates of recruitment (see Agroforestry Mourning Dove Project Update below).

Long-term Localized Banding Study

Given the increasing popularity of dove hunting near urban areas, local dove harvests and associated intensity of managing sunflower fields have increased substantially on numerous conservation areas. Managers and biologists, however, have limited knowledge of how these locally intensive harvests effect populations. For example, what subpopulations or subgroups of mourning doves are harvested on these areas; locally established populations or different migratory subpopulations passing through the area? What are some plausible explanations for observed annual fluctuations in year-to-year harvests on these managed areas?

Using a collaborative effort between research and management staff to address these issues, a long-term banding study (>10-years) was initiated in 2000 at the James A. Reed Memorial Wildlife Area. Trapping annually occurs during the summer (July 1 – August 21); 1,000 doves is the target sample size. It will be several more years before any meaningful conclusions can be made.

Mourning Doves and Lead (Pb) Shot Research

Pb Pellet Deposition and Availability

Abstract: Mourning dove hunting is becoming increasingly popular, especially hunting over managed shooting fields. Given the possible increase in lead (Pb) shot availability on these conservation areas, we estimated availability and ingestion of spent shot at the Eagle Bluffs Conservation Area (EBCA; hunted with nontoxic shot) and the James A. Reed Memorial Wildlife Area (JARWA; hunted with Pb shot) in Missouri. During 1998, we collected soil samples 1–2 weeks prior to the hunting season (prehunt) and after 4 days of dove hunting (posthunt). We also collected information on number of doves harvested, number of shots fired, shotgun gauge, and shotshell size used. Dove carcasses were collected on both areas during 1998-99. At EBCA, 60 hunters deposited an estimated 64,775 pellets/ha of nontoxic shot on or around the managed field. At JARWA, approximately 1,086,275 pellets/ha of Pb shot were deposited by 728 hunters. Our posthunt estimates of spent shot availability from soil sampling were 0 pellets/ha for EBCA and 6,342 pellets/ha for JARWA. Our findings suggest that existing soil sampling protocols may not provide accurate estimates of spent shot availability in managed dove shooting fields. During 1998-99, 15 of 310 (4.8%) mourning doves collected from EBCA had ingested nontoxic shot. For doves that ingested shot, 6 (40.0%) contained ≥7 shot pellets. In comparison, only 2 of 574 (0.3%) doves collected from JARWA had ingested Pb shot. Because a greater proportion of doves ingested multiple steel pellets compared to Pb pellets, we suggest that doves feeding in fields hunted with Pb shot may succumb to acute Pb toxicosis and thus become unavailable to harvest, resulting in an underestimate of ingestion rates. Although further research is needed to test this hypothesis, our findings may partially explain why previous studies have shown few doves with ingested Pb shot despite feeding on areas with high Pb shot availability. Funding and support for this study were provided by the Missouri Department of Conservation's Resource Science Center (Federal Aid in Wildlife Restoration Project W-13-R), and the University of Missouri's Department of Fisheries and Wildlife Sciences. (Full details available in Wildlife Society Bulletin; 2002, 30(1):112-120)

Acute Lead (Pb) Toxicosis

Abstract: Previous research has suggested that free-ranging mourning doves may ingest spent lead pellets, succumb to lead toxicosis, and die in a relatively short time period (i.e., an acute lead toxicosis hypothesis). We tested this hypothesis by administering 157 captive mourning doves 2–24 lead pellets, monitoring pellet retention and short-term survival, and measuring related physiological characteristics. During the 19–21-day post-treatment period, 104 doves that received lead pellets died (deceased doves) and 53 survived (survivors); all 22 birds in a control group survived. Within 24-hr of treatment, blood lead levels increased almost twice as fast for deceased doves compared to survivors ($P < 0.001$). During the first week, heterophil:lymphocyte (H:L) ratios increased twice as fast for deceased doves than with survivors ($P < 0.001$). Post-treatment survival differed ($P < 0.001$) among the five groups of doves that retained different numbers of pellets, and survival ranged from 0.57 (95% CI: 0.44–0.74) for doves that retained ≤2 lead pellets 2-days post-treatment compared to 0.08 (95% CI: 0.022–0.31) for those doves that retained 13–19 lead pellets on 2-days post-treatment; significant differences existed among the five groups. After controlling for dove pre-treatment body mass, each additional lead pellet increased the hazard of death by 18.0% (95% CI: 1.132–1.230, $P < 0.001$) and 25.7% (95% CI: 1.175–1.345, $P < 0.001$) for males and females, respectively. For each 1 g increase in pre-treatment body mass, the hazard of death decreased 2.5% ($P = 0.04$) for males and 3.8% ($P = 0.02$) for females. Deceased doves had the highest lead levels in liver (49.20 ± 3.23 ppm) and kidney (258.16 ± 21.85 ppm) tissues, whereas controls showed the lowest levels (liver, 0.08 ± 0.041 ppm; kidney, 0.17 ± 0.10 ppm). For doves dosed with pellets, we observed simultaneous increases in blood lead levels and H:L ratios, whereas packed-cell volume (PCV) values declined. Our results support an acute lead toxicosis hypothesis. Funding and support for this study were provided by the Missouri Department of Conservation's Resource Science Center, and the University of Missouri's Department of Fisheries and Wildlife Sciences and Veterinary Medicine Diagnostic Laboratory. All animal care and use during these experiments were approved by the University of Missouri Animal Care and Use Committee (Full details available in Journal of Wildlife Management; 2006, 70(2):413–421).

Experimental Lead Pellet Ingestion In Mourning Doves

Abstract: Because the relationship between lead pellet availability and ingestion by mourning doves remains uncertain, we conducted an experiment to determine if doves held in captivity freely ingest lead shotgun pellets, investigate the relationship between pellet density and ingestion, and monitor physiological impacts of doves ingesting pellets. We conducted two trials of the experiment with <60 doves per trial. We randomly assigned 10 doves to one of six groups per trial; 10, 25, 50, 100, 200 pellets mixed with food and a control group with no pellets. We monitored ingestion by examining x-rays of doves 1-day post-treatment, and monitored the effects of lead ingestion by measuring heterophil:lymphocyte (H:L) ratios, packed-cell volume (PCV), blood lead, liver lead, and kidney lead. Pooled data from both trials showed 6 of 117 (5.1%) doves ingested lead pellets. Two mourning doves ingested multiple lead pellets in each of the treatments containing a mixture of 25, 100, and 200 lead pellets and food. Doves ingesting lead pellets had higher blood lead levels than before treatment ($P = 0.031$). Post-treatment H:L ratios, however, were not different compared to pre-treatment values ($P = 0.109$). Although post-treatment PCV decreased for 4 of 6 doves ingesting lead pellets, overall they were not lower than their pre-treatment values ($P = 0.344$). Liver ($P < 0.0001$) and kidney ($P = 0.0012$) lead levels for doves ingesting pellets were higher than doves without ingested pellets. Our lead pellet ingestion rates were similar to previously reported ingestion rates from hunter-killed doves, and our physiological measurements confirm earlier reports of a rapid and acute lead toxicosis. Similar to previous field

research, we did not observe a relationship between pellet density in the food and *ad libitum* pellet ingestion. (Full details available in American Midland Naturalist; 2007, 158(1):177–190)

Small Game Hunter Attitudes Towards Nontoxic Shot

Abstract: Besides waterfowl, wildlife managers are becoming more concerned about the exposure of birds to spent lead shot. Knowledge of hunter attitudes and their acceptance of nontoxic shot regulations will be important in establishing new regulations. Our objective was to assess the attitudes of small game hunters in Missouri towards a nontoxic shot regulation for small game hunting in general, and specifically for mourning doves. Most hunters (71.7–84.8%) opposed additional nontoxic shot regulations. Hunters from rural areas, hunters with a rural background, hunters who hunt doves, hunters who currently hunt waterfowl, hunters who primarily used private lands, and current upland game hunters were more likely to oppose new regulations. For mourning dove hunting, most small game hunters (81.1%) opposed further restrictions; however, many non-dove hunters (57.1%) expressed "no opinion." Because our results demonstrate that most small game and dove hunters in Missouri are decidedly against further nontoxic shot regulations, any informational and educational programs developed to accompany future policy changes must address there concerns. Funding and support for this study were provided by the Missouri Department of Conservation's Resource Science Center, and the University of Missouri's Department of Fisheries and Wildlife Sciences. (Full details available in Journal of Wildlife Management; 2007, 71(2):628–633)

Nontoxic Shot and Crippling Rates

Abstract: Increasing concerns about the exposure of mourning doves to spent lead shot may lead to a review of lead shot restrictions. Policy reviews regarding current restrictions likely will involve debates about whether nontoxic shot requirements will result in increased crippling loss of mourning doves. We evaluated waterfowl crippling rates in the United States prior to, during, and after implementation of nontoxic shot regulations for waterfowl hunting. We used this information to make inferences about mourning dove crippling rates if nontoxic shot regulations are enacted. We found differences in moving average crippling rates among the 3 treatment periods for ducks ($P < 0.001$, $n = 49$). Prenontoxic-shot-period crippling rates were lower than 5-year phase-in period crippling rates ($P = 0.043$) but higher ($P < 0.001$) than nontoxic-shot-period crippling rates. Similarly, we observed differences in moving average crippling rates among the 3 treatment periods for geese ($P < 0.001$, $n = 49$). Prenontoxic-shot- and 5-year-phase-in-period crippling rates were both greater than ($P < 0.001$) nontoxic-shot-period crippling rates but did not differ from one another ($P = 0.299$). Regardless of why the observed increases occurred in reported waterfowl crippling rates during the phase-in period, we believe the decline that followed full implementation of the nontoxic shot regulation is of ultimate importance when considering the impacts of lead shot restrictions for mourning doves. We argue that long-term mourning dove crippling rates might not increase as evidenced from historical waterfowl data. Funding and support for this investigation were provided by the Missouri Department of Conservation's Resource Science Center, and the University of Missouri's Department of Fisheries and Wildlife Sciences and Veterinary Medicine Diagnostic Laboratory. (Full details available in Wildlife Society Bulletin; 2006, 34(3):861–865)

Agroforestry and Mourning Dove Research Update

Future improvements in mourning dove harvest management will rely on information that cannot be obtained from simple roadside trend data. Rather, the National Mourning Dove Strategic Harvest Management Plan shows that future harvest management decisions will be based upon mechanistic population models, requiring modern estimates of demographic characteristics (e.g., recruitment, survival). Broad spatial scale estimates of survival and recruitment can be obtained from a sample of banded individuals along with a sample of wings from hunter-killed doves. However, the impacts of intensively utilized local populations are uncertain. Therefore, our objectives are (1) to estimate local mourning dove population characteristics (e.g., recruitment, survival) and local harvest characteristics (e.g., harvest rates, crippling rates) during 2005-2010, and (2) evaluate agroforestry practices while determining the efficacy of associated number of sunflower fields and field size to attract mourning doves for harvest on James A. Reed Memorial Wildlife Area (JARMWA) during 2005-2010. Knowledge generated from this project will also guide management decisions for private landowners combining agroforestry practices and managed dove hunting fields, provide information about relationships between observed recruitment from radio marked doves and fall age-ratios from hunter-killed doves, provide comparisons of actual and reported crippling rates during the hunting season, and provide information on harvest rates on a heavily harvested local population of mourning doves.

During 2005–2007 we implanted subcutaneous transmitters with external antennas in 589 doves. Of the 589 dove implanted with transmitters, 66 were implanted in nestling doves prior to fledging (2005 = 10 nestlings, 2006 = 35 nestlings, 2007 = 21 nestlings). Time needed to implant transmitters required approximately 9–10 minutes per procedure. For survival analysis, the maximum number of birds at risk during a given day during a field season ranged from 26–46 for AHY and 36–44 for HY; we increased our sample size in late summer each year to increase the precision of survival estimates during the hunting season. We used the Kaplan–Meier product limit estimator with staggered entry to initially estimate survival by age class and year (Figures 18–19). Crippling rates reported by hunters as the number of birds shot and not retrieved averaged 16.8% during the month of September compared to an actual crippling rate estimate of 9.0% using available radio-marked doves available on the area during opening day of the hunting season.

These are preliminary results from the first 3-years of a 5-year project. The project is a cooperative venture including the Webless Migratory Game Bird Research Program (U.S. Fish and Wildlife Service), University of Missouri's Center for Agroforestry, University of Missouri School of Fisheries and Wildlife Sciences, U.S. Forest Service - North Central Forest Experiment Station, and Resource Science Division of the Missouri Department of Conservation.

Table 1. Estimates of the number of dove harvest, hunters, and days afield by state in the Central Management Unit (CMU; Figure 2) from the Migratory Game Bird Harvest Information Program (HIP) survey for the 2007-08 hunting season.

	HARVEST		HUNTERS		DAYS	
Arkansas	791,700	(±24)[1]	37,000	(±16)	115,900	(±23)
Colorado	315,000	(±14)	21,800	(±11)	57,800	(±14)
Kansas	725,100	(±13)	36,300	(±8)	119,100	(±11)
Minnesota	67,400	(±52)	7,700	(±35)	27,600	(±49)
Missouri	603,300	(±15)	42,600	(±8)	124,400	(±13)
Montana	20,900	(±43)	1,700	(±31)	4,000	(±34)
Nebraska	319,600	(±18)	12,000	(±12)	55,300	(±16)
New Mexico	198,700	(±25)	8,600	(±18)	40,100	(±33)
North Dakota	48,700	(±27)	3,200	(±27)	9,900	(±26)
Oklahoma	480,000	(±24)	24,600	(±14)	73,100	(±19)
South Dakota	104,000	(±30)	6,000	(±20)	18,200	(±25)
Texas	5,463,300	(±14)	275,200	(±10)	1,149,600	(±13)
Wyoming	42,600	(±27)	4,000	(±20)	8,800	(±24)
CMU Total	9,180,200	(±9)	485,700[2]		1,803,900	(±9)

[1]This represents the 95% confidence interval expressed as percent of the point estimate.

[2]This total may be slightly exaggerated because some people may be counted more than once if they hunted in more than one state, and explains why there is no estimated confidence interval.

Table 2a. Percent change of the 2008 Roadside Mourning Dove Survey relative to 2007, 5-year (2003–07), and 10-year (1998–07) averages by Zoogeographic regions (Figure 1a).

Zoogeographic regions	**2008 Index**	**2-year (2007-2008) % change**	**5-year (2003-2007) % change**	**10-year (1998-2007) % change**
Northwest Prairie (11)	1.46	-4.47	-18.54	-15.81
Northern Riverbreaks (11)	0.94	-25.43	-31.17	-29.91
Northeast Riverbreaks (20)	1.63	24.59	16.71	24.13
Western Prairie (12)	1.59	-10.56	-9.54	-12.36
Western Ozark Border (13)	1.39	-12.69	-18.18	-13.53
Ozark Plateau (24)	0.68	-27.59	-5.24	4.38
Northern and Eastern Ozark Border (12)	0.95	-8.17	0.20	-6.00
Mississippi Lowlands (7)	2.49	-18.48	-13.19	-10.92
STATEWIDE (110)	1.28	-8.97	-8.94	-6.43

[a]Survey index is equal to the number of mourning doves observed per mile.
[b]Number of counties within zoogeographic region with a completed and returned survey route.

Table 2b. Percent change of the 2008 Roadside Mourning Dove Survey relative to 2007, 5-year (2003–07), and 10-year (1998–07) averages by MDC Management regions (Figure 1b).

MDC management regions	**2008 Index**	**2-year (2007-2008) % change**	**5-year (2003-2007) % change**	**10-year (1998-2007) % change**
Northwest (19)	1.21	-15.65	-25.78	-24.42
Northeast (15)	1.47	20.94	11.91	19.81
Kansas City (10)	1.52	-14.18	-22.48	-22.19
Central (15)	1.56	-0.72	11.78	15.88
St. Louis (6)	0.77	-8.50	33.41	15.01
Southwest (17)	1.23	-9.63	-13.48	-4.80
Ozark (12)	0.63	-21.20	-6.17	3.57
Southeast (16)	1.52	-19.12	-8.13	-11.54
Statewide (110)	1.28	-8.97	-8.94	-6.43

[a]Survey index is equal to the number of mourning doves observed per mile.
[b]Number of counties within zoogeographic region with a completed and returned survey route.

Table 3. Dove harvest characteristics during September 2007 from conservation areas cooperating with an Adaptive Resource Management (ARM) program to evaluate the effects of different hunter and harvest management strategies on the goal of maximizing hunting opportunities[1].

Area	Number of Hunters	Doves Killed	Shots Fired	Hours Hunted	Doves Shot and Not Retrieved
A. A. Busch CA	832	1059	7045	2528	209
Bois D'Arc CA	818	1838	12687	2686	465
Columbia Bottom CA	1150	4952	25527	4088	758
Davisdale CA	66	225	930	161	38
Eagle Bluffs CA	153	533	2479	431	101
Franklin Island CA	92	308	1760	256	100
Overton Bottoms CA	80	353	1985	248	49
Otter Slough CA	217	1136	4228	554	105
Pony Express CA	834	2350	12827	2566	444
J. A. Reed Mem. WA	1272	2470	13034	4161	488
R. E. Talbot CA	529	1869	9642	1624	359
Ten Mile Pond CA	397	3272	11225	844	288

[1]It is important to note that these areas represent just a few dove hunting opportunities on public areas, and are part of a long-term management experiment. The Department provides managed mourning dove hunting opportunities on approximately 5,000 acres located on 150 fields located on 92 public conservation areas.

Table 4. Managed shooting field characteristics and relative distribution of the harvest characteristics by relative field size, during 2007.

Area Code	Area Name	# Acres	# Fields	Ave. Field Size	Doves Killed per Acre[1]	Hunters per Acre[2]	Hours per Acre[3]	Shots per Acre[4]
ABCA	August A Busch CA	123.2	11	11.2	8.6	6.8	20.5	57.2
BDCA	Bois D'Arc CA	312.6	88	3.6	1.5	1.0	3.3	9.5
CBCA	Columbia Bottoms CA	166.5	20	8.3	29.7	6.9	24.6	153.3
DACA	Davisdale CA	16.0	1	16.0	14.1	4.1	10.1	58.1
EBCA	Eagle Bluffs CA	53.0	3	17.7	10.1	2.9	8.1	46.8
FICA	Franklin Island CA	26.0	1	26.0	11.8	3.5	9.8	67.7
OBCA	Overton Bottom CA	32.0	1	32.0	11.0	2.5	7.8	62.0
OSCA	Otter Slough CA	1148.5	19	60.4	1.0	0.2	0.5	3.7
PECA	Pony Express CA	155.0	22	7.0	15.2	5.4	16.7	82.8
RMWA	James A Reed Mem. WA	151.1	17	8.9	16.3	8.4	27.5	86.3
TACA	Talbot CA	116.0	35	3.3	11.8	4.2	14.3	83.8
TMCA	Ten Mile Pond CA	145.0	7	20.7	22.2	2.7	5.8	77.4
TOTAL		2,293.8	208	11.0	8.0	2.6	8.1	40.9

[1]Represents doves killed per managed acre during the entire month of September.
[2]Represents the number of hunters per managed acre during the entire month of September.
[3]Represents the number of hours spent by hunters per managed acre during the entire month of September; all hours were rounded up the next whole number.
[4]Represents shots per managed acre during the entire month of September.

*Data unavailable

Table 5. Number of hunting trips made by hunters estimated by matching conservation numbers throughout the month of September, 2007; e.g., 386 hunters made one dove hunting trip on ABCA and 107 hunters made two trips, etc. Not all hunters provided a usable conservation number (see Table 4 for abbreviations of area names).

# Days Hunted	ABCA	BDCA	CBCA	DACA	EBCA	FICA	OBCA	OSCA	PECA	RMWA	TACA	TMCA	Total Hunting Trips	% Hunting Trips
1	386	176	755	24	67	83	68	110	465	656	325	151	3266	77.50
2	107	36	112	9	24	1	6	23	98	160	61	60	697	16.54
3	20	7	24	6	7			13	13	49	1	9	149	3.54
4	14	6	8		1			1	6	14		4	54	1.28
5	4	1	5					1	1	5		1	18	0.43
6	3			1				1	2	1		1	9	0.21
7	1					1		1		2		1	6	0.14
8									1	1		1	3	0.07
9			1									1	2	0.05
>10	2	1	1		1				1	1	1	2	10	0.24
Total	537	227	906	40	100	85	74	150	587	889	388	231	4214	100.00

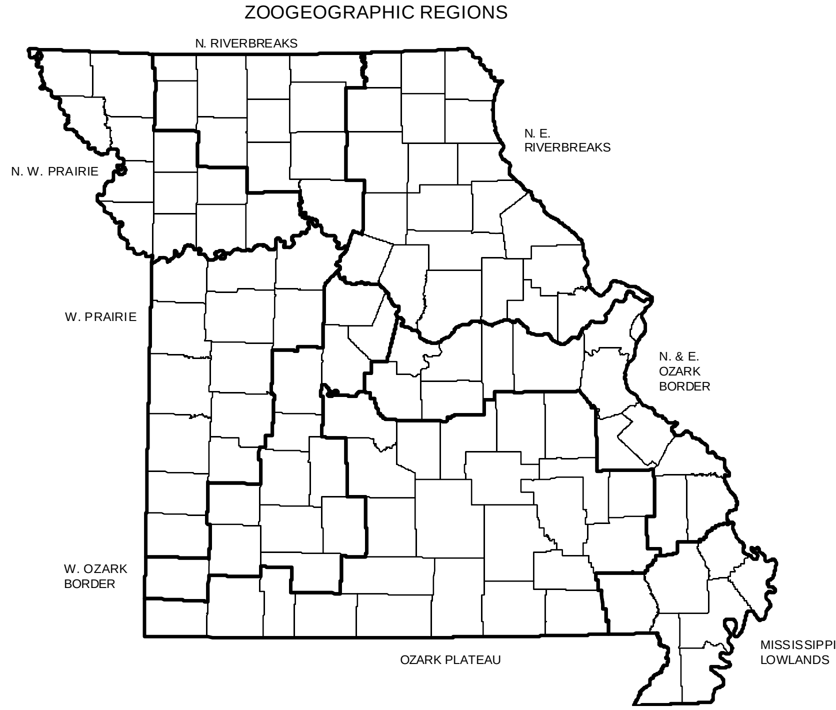


Figure 1a. Zoogeographic regions of Missouri.

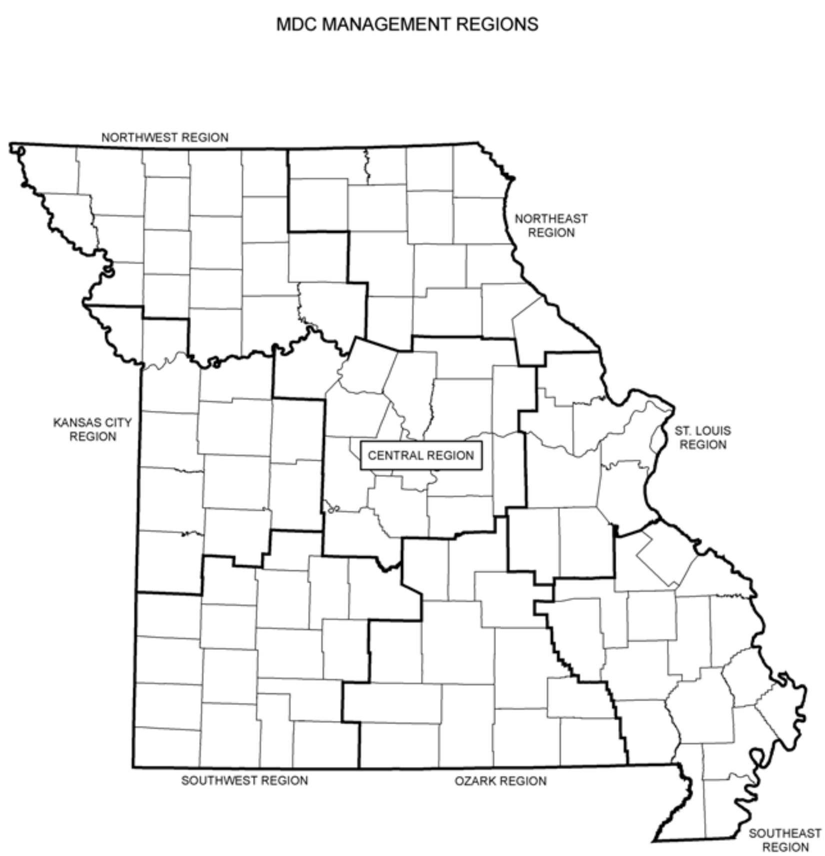


Figure 1b. MDC management regions.

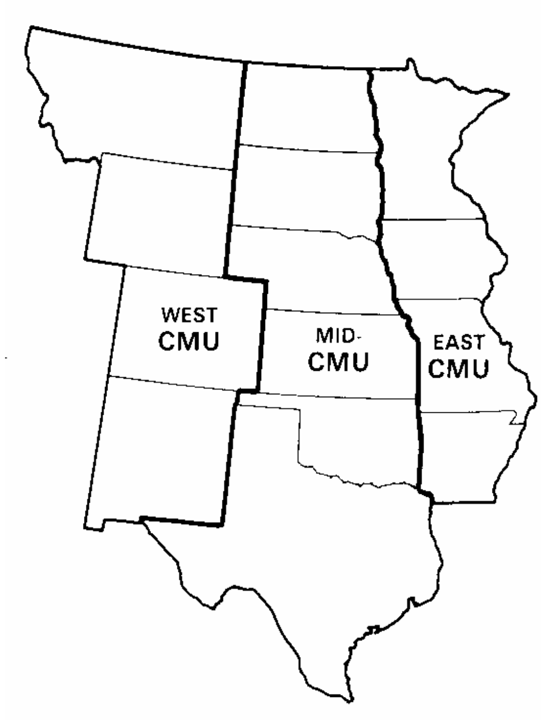


Figure 2a. The Central Management Unit (CMU) consists of 14 states containing roughly 46% of the land U.S. land area, and routinely has the highest Call-Count Survey (CCS) indices in the country.

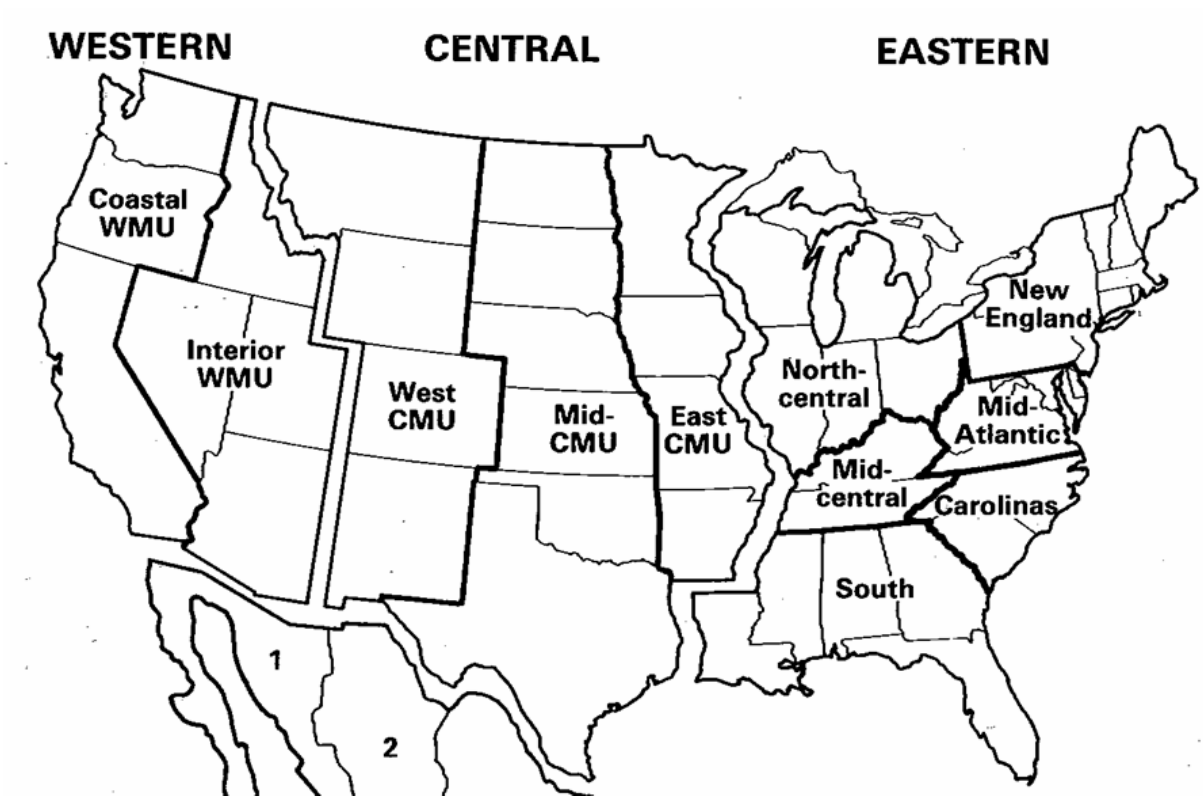


Figure 2b. Within the United States, there are 3 zones, or management units, that contain mourning dove populations that are roughly independent of each other. These zones encompass the principle breeding, migration, and U.S. wintering areas for each population. Harvest management decisions are annually established by management unit.

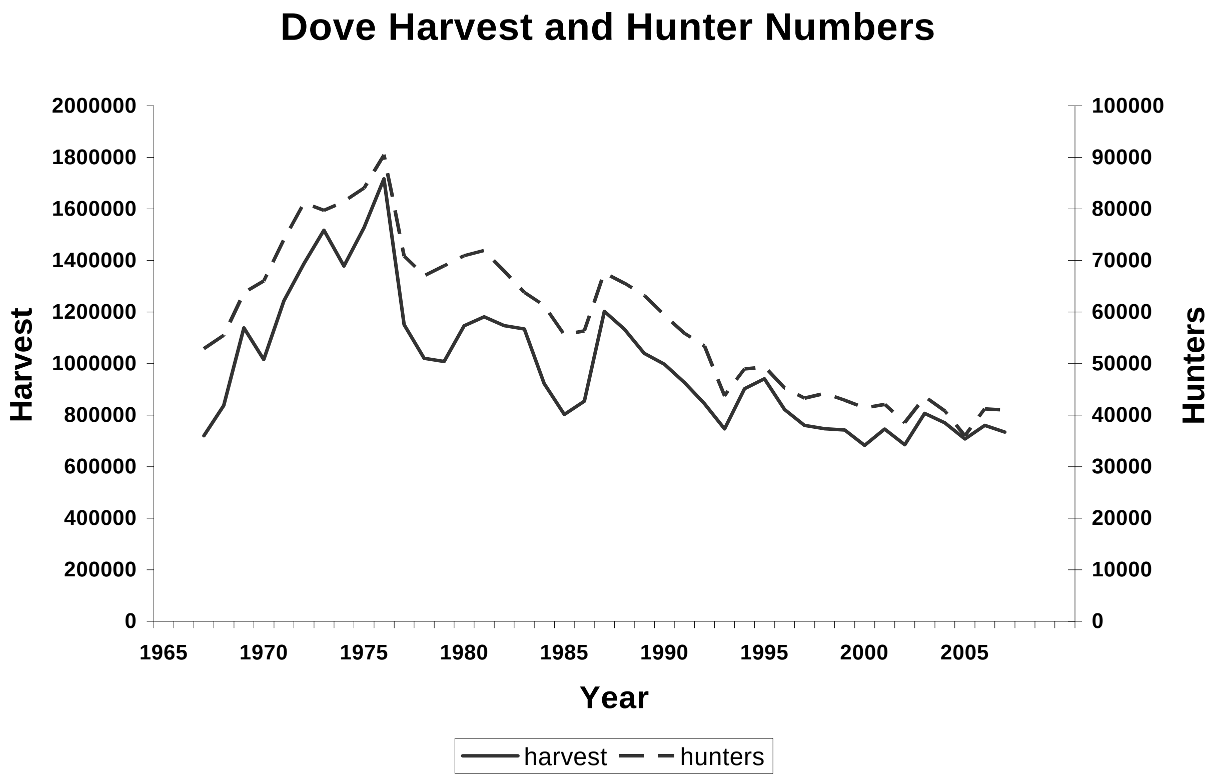


Figure 3. Long-term trends (1967– 2007) of mourning dove harvest and number of dove hunters in Missouri estimated annually by the small-game post-season harvest mail survey.

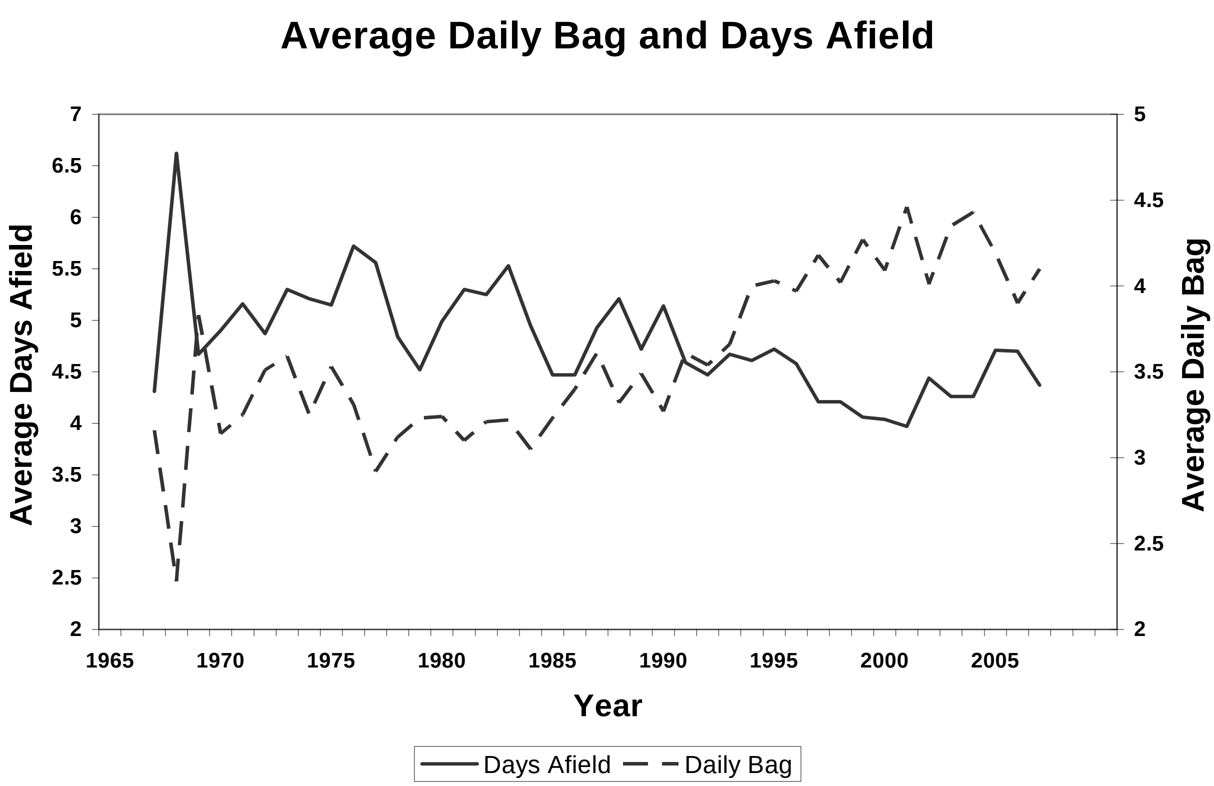


Figure 4. Long-term trends (1967–2007) of mourning dove average daily bag limit and average number of days afield for Missouri dove hunters estimated annually by the small-game post-season harvest mail survey.

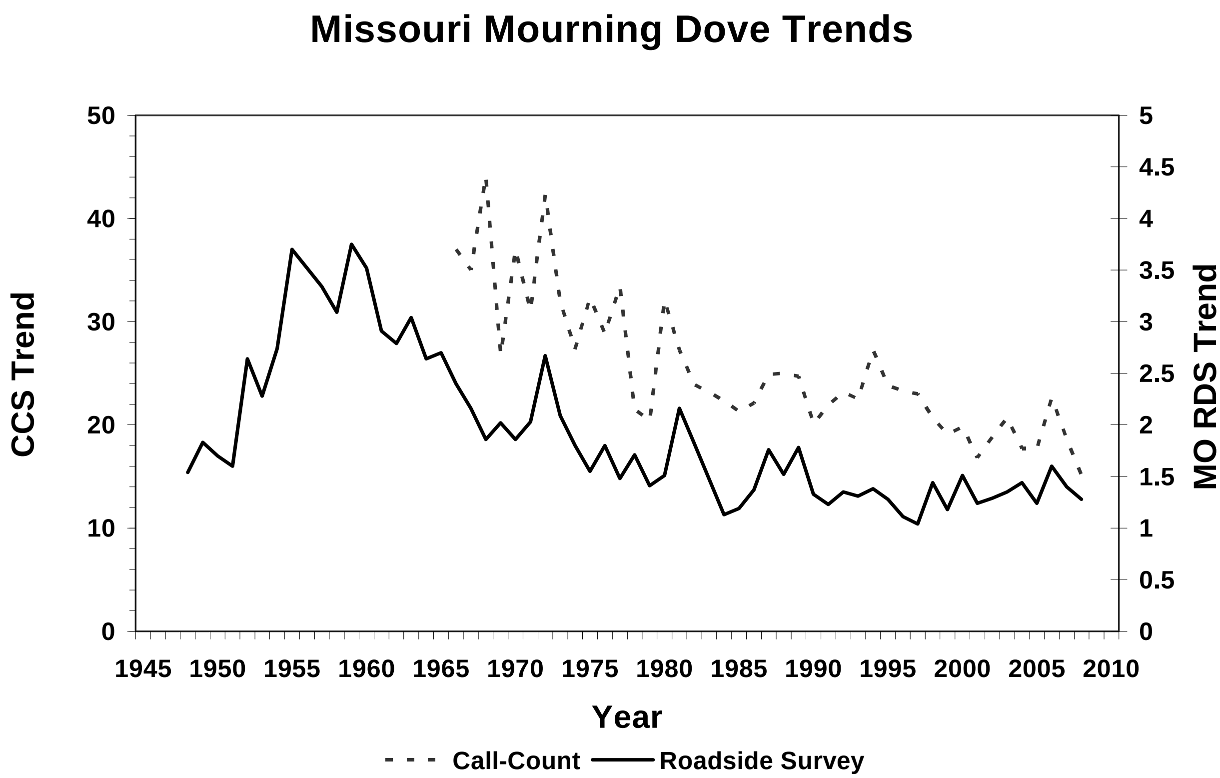


Figure 5. Missouri roadside mourning dove survey (RDS; doves observed along survey route) expressed as doves/mile (1948–2008) and U.S. Fish and Wildlife Service mourning dove call-count survey (CCS; doves heard calling) route regression trend analysis (1966–2008).

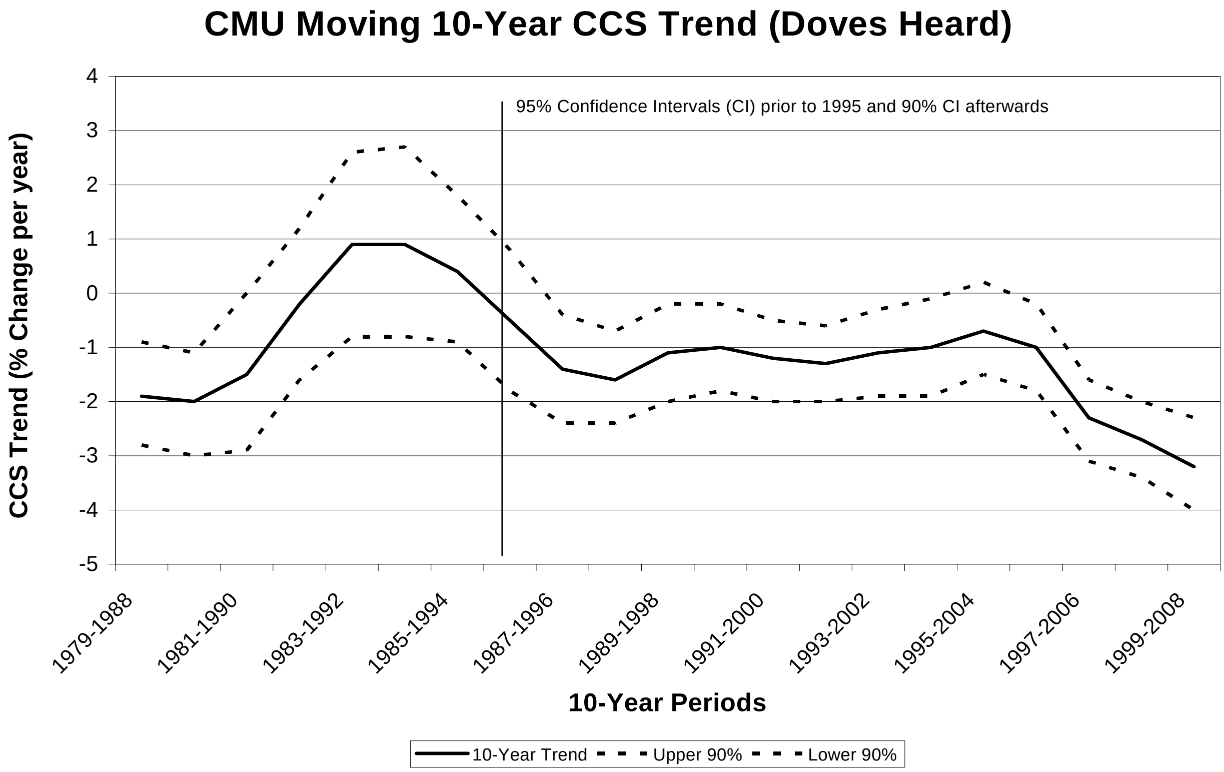


Figure 6a. Moving 10-year trends (expressed at percent change per year in the Central Management Unit (CMU) as determined by linear regression) in number of mourning doves heard along Call-Count Survey (CCS) routes.

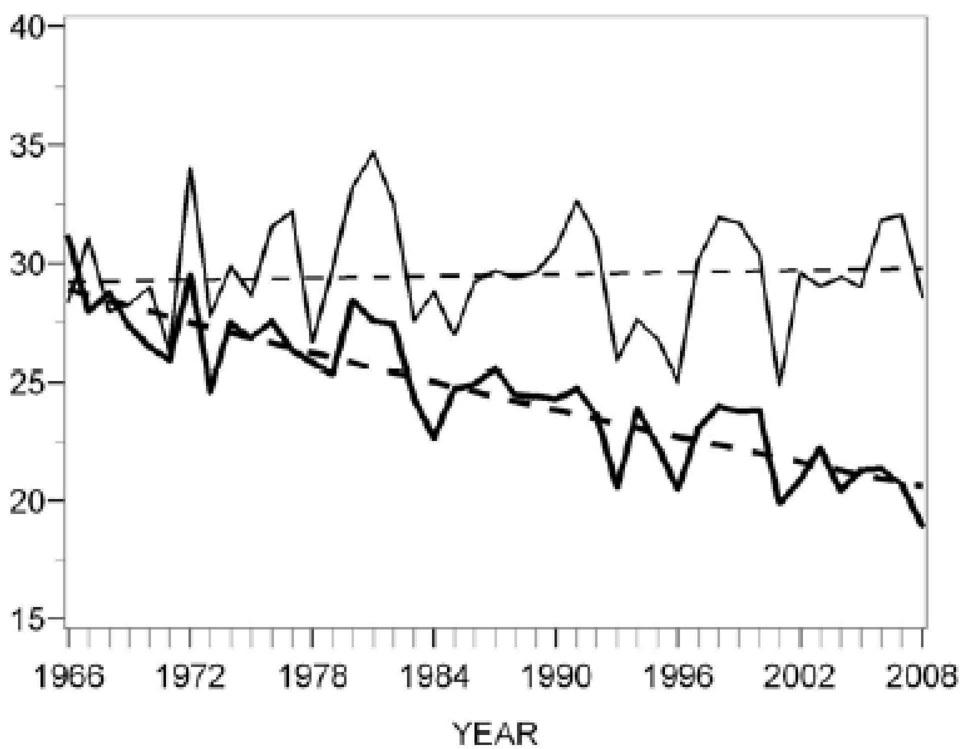
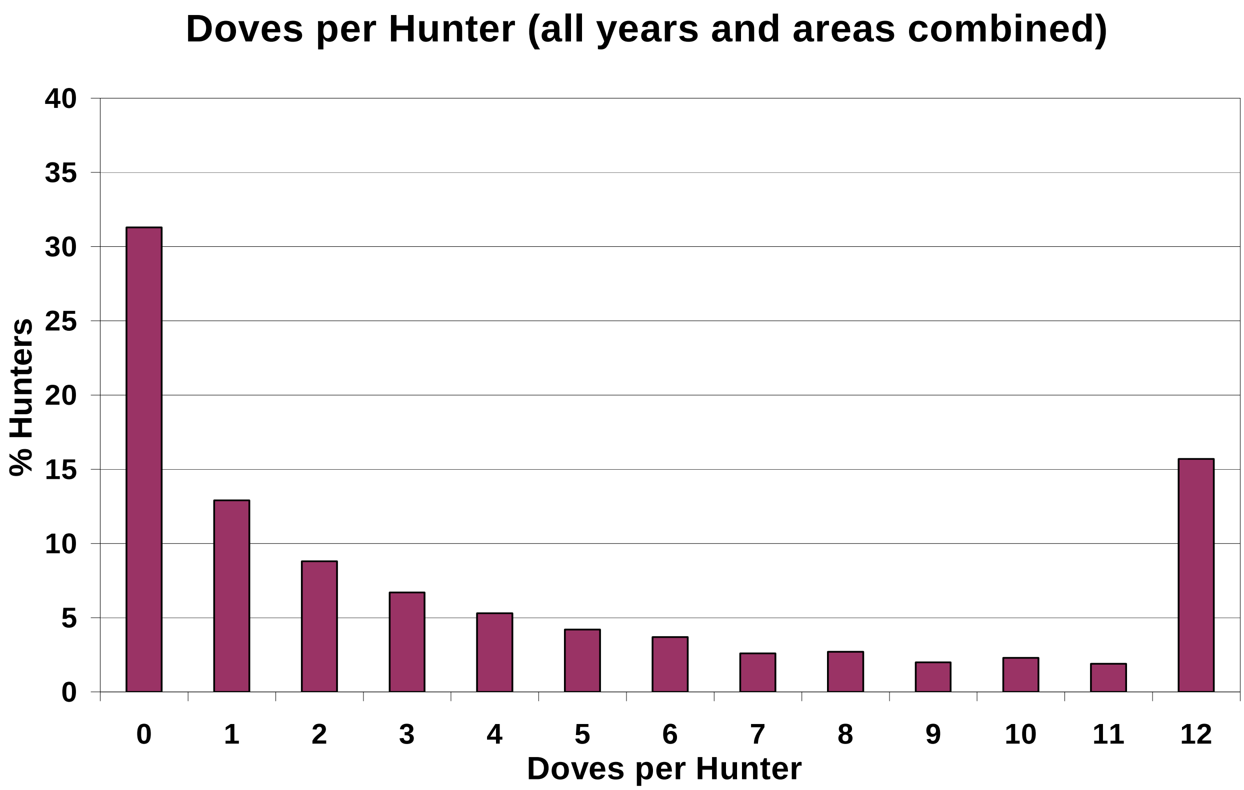


Figure 6b. Call-Count Survey (CCS) trends in the Central Management Unit (CMU) of doves heard calling (heavy solid line) and doves observed (light solid line) for the Central Management Unit (CMU); dashed lines present predicted trends (from the USFWS 2008 Mourning Dove Status Report).



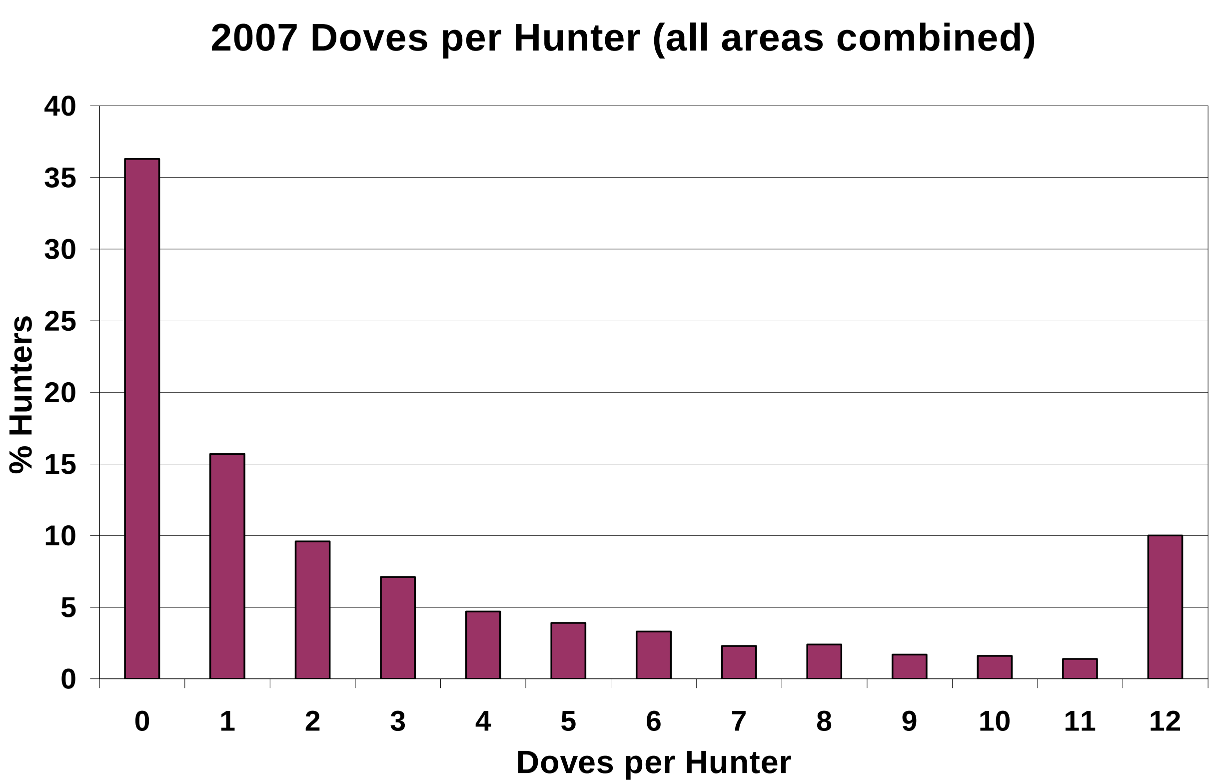
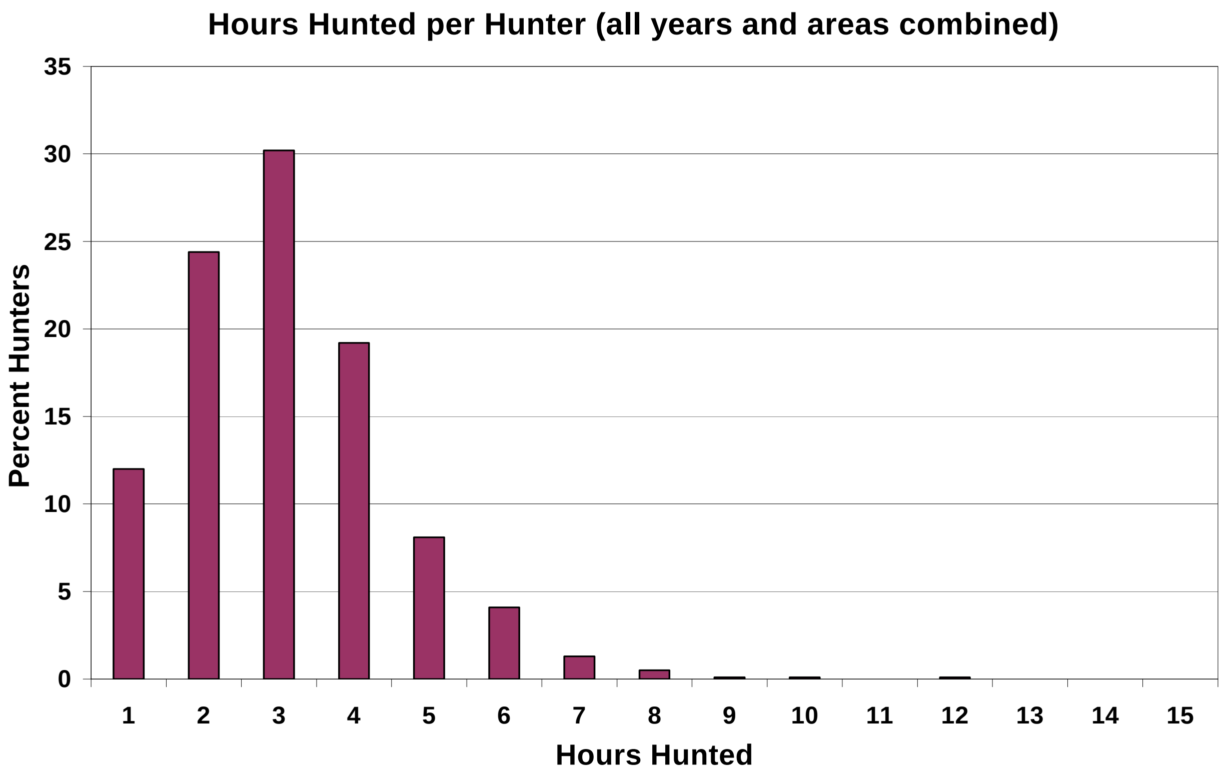


Figure 7. Distribution of the number of doves killed per hunter for all years and areas combined (top graph), and for 2007 with all areas combined (bottom graph). Data from conservation areas cooperating with an ARM program to evaluate harvest management activities.



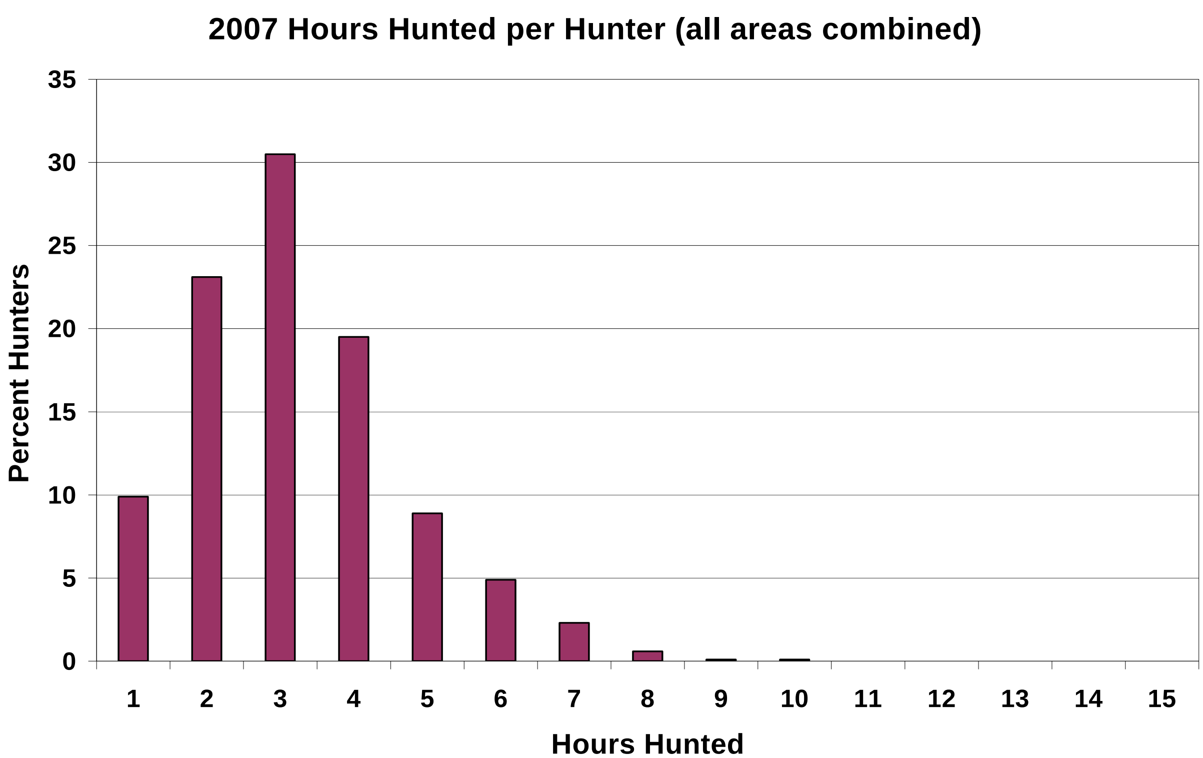


Figure 8. Number of hours hunted by dove hunters with all areas and years combined (top graph), and for 2007 (all areas combined; bottom graph); -99 represents hunters who reported hunting but did not provide an estimate of hours hunted, or an estimate exceeding 15 hours. Data from conservation areas cooperating with an ARM program to evaluate harvest management activities.

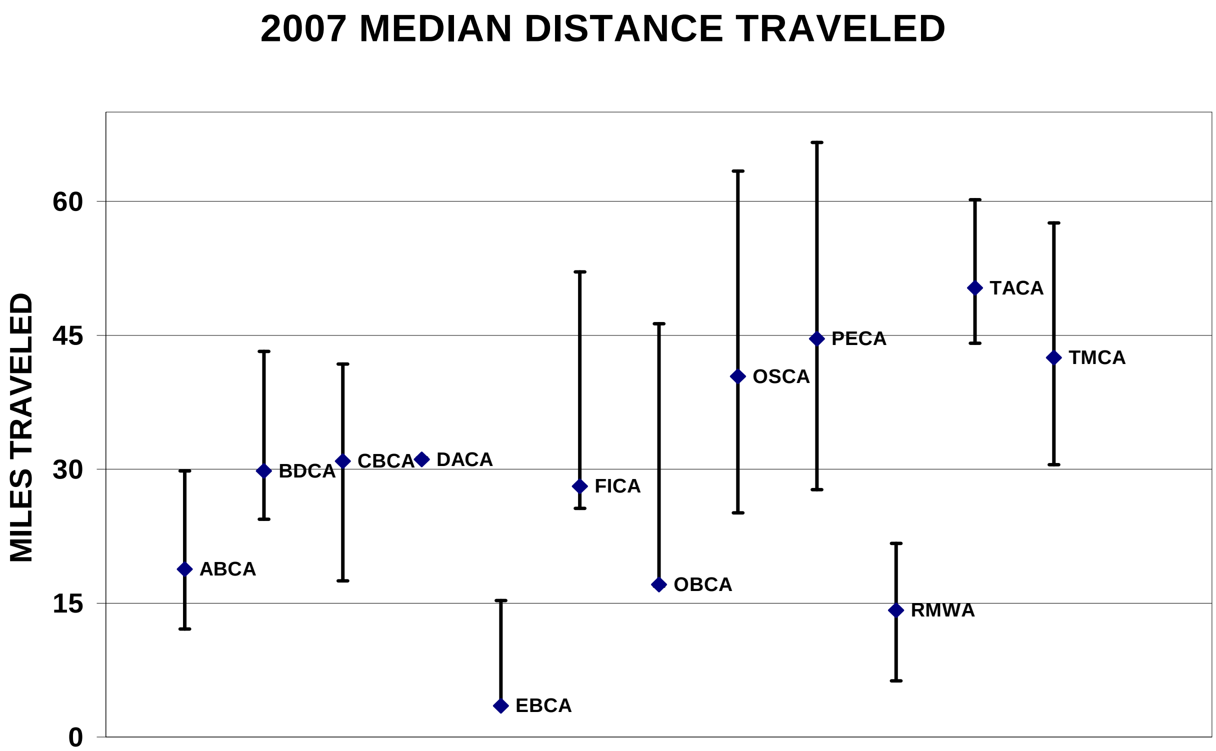


Figure 9. Median distance traveled during 2007 to hunt doves (diamond; Q2 or 50th percentile) and 25th percentile (lower tick mark; Q1) and 75th percentile (upper tick mark; Q3); see Table 4 for abbreviations of area names**.**

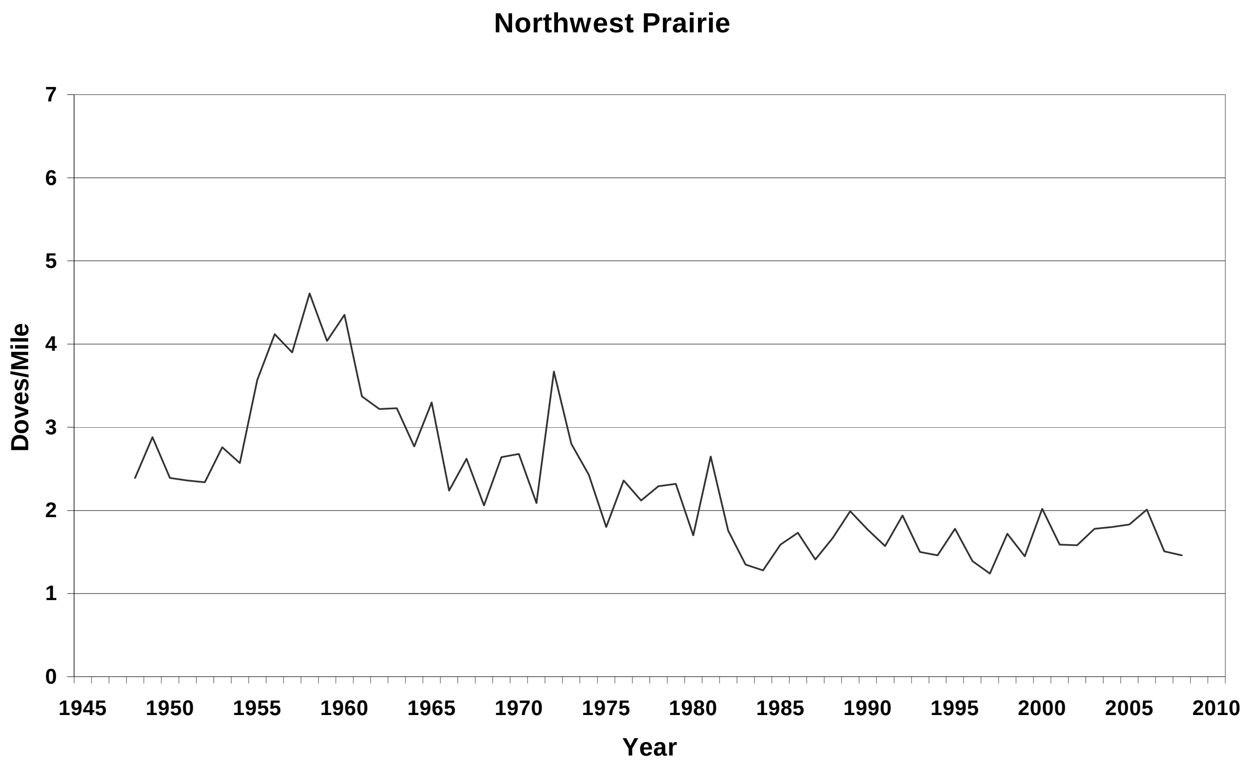


Figure 10. Northwest Prairie Zoogeographic Region.

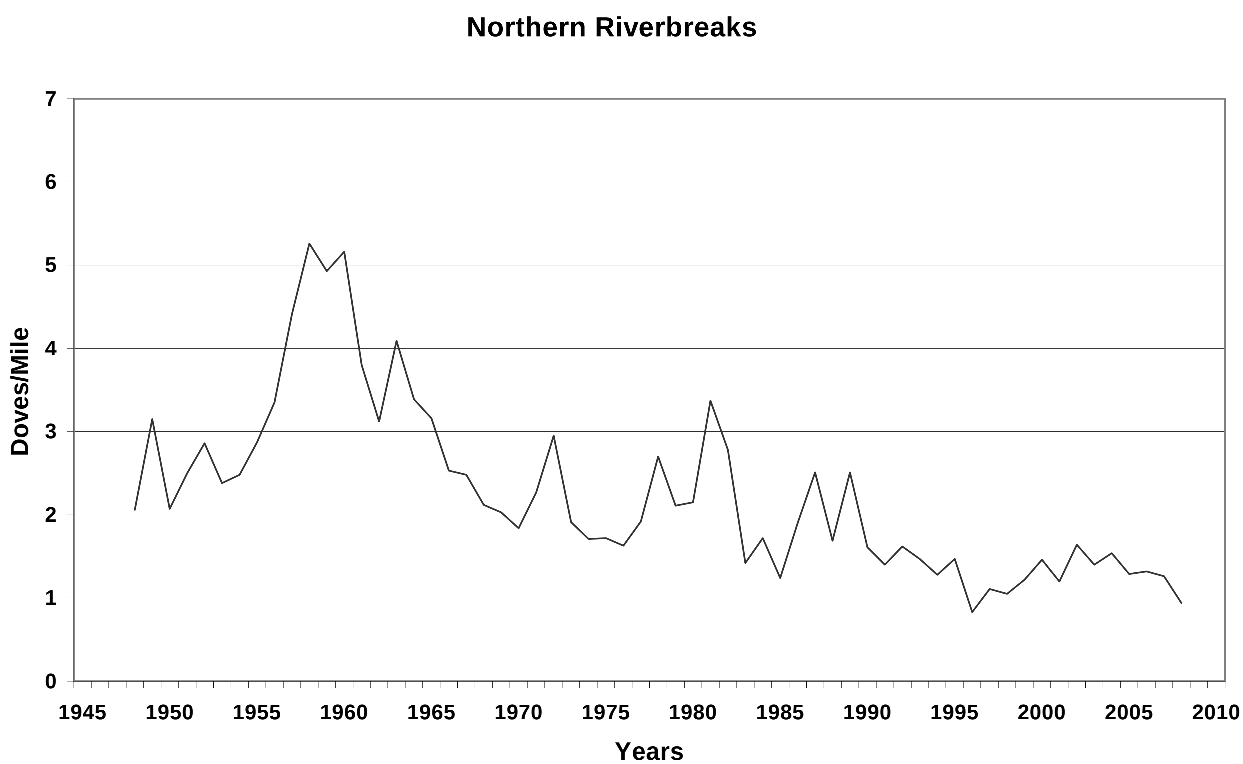


Figure 11. Northern Riverbreaks Zoogeographic Region.

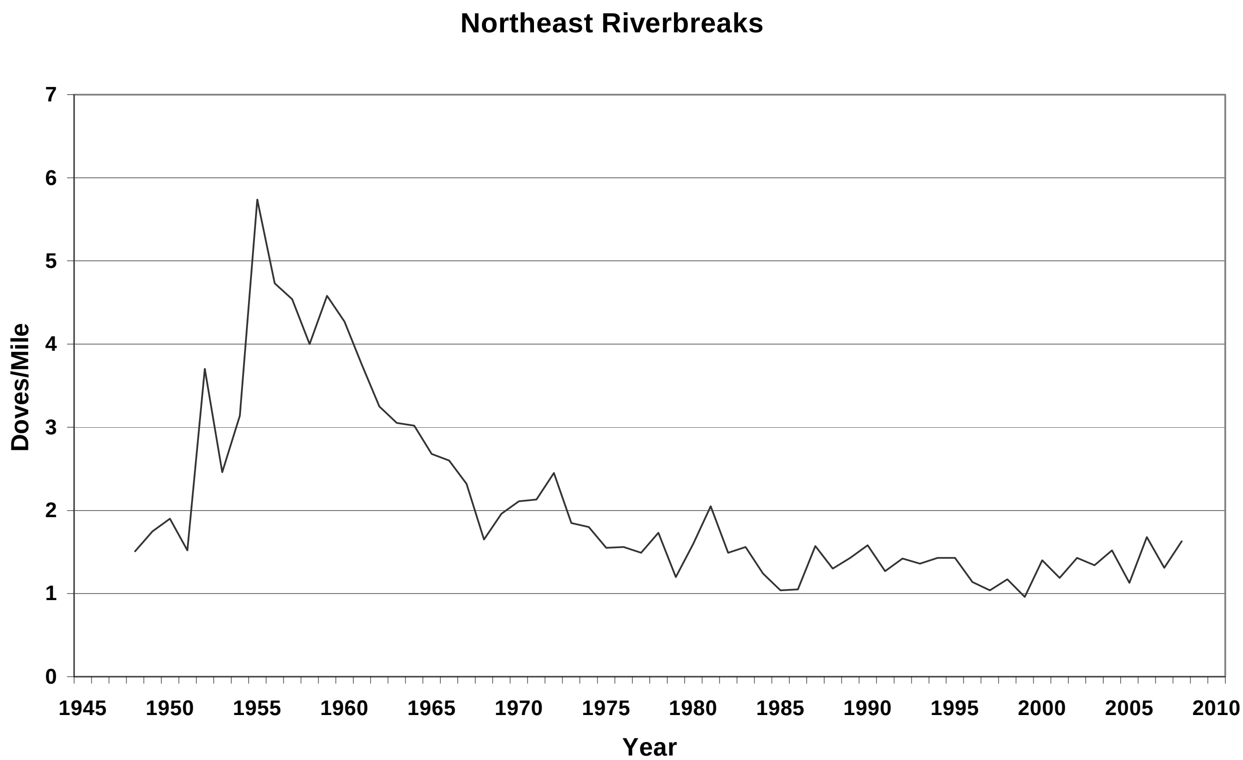


Figure 12. Northeast Riverbreaks Zoogeographic Region.

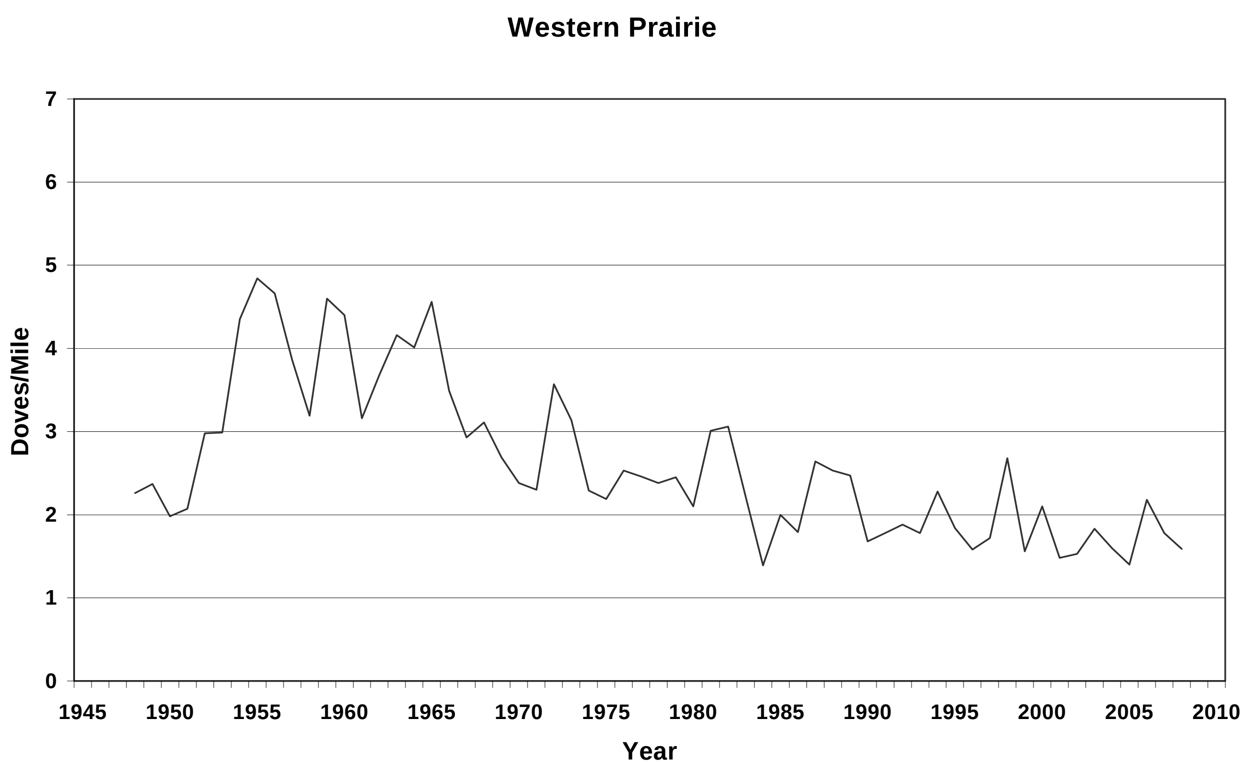


Figure 13. Western Prairie Zoogeographic Region.

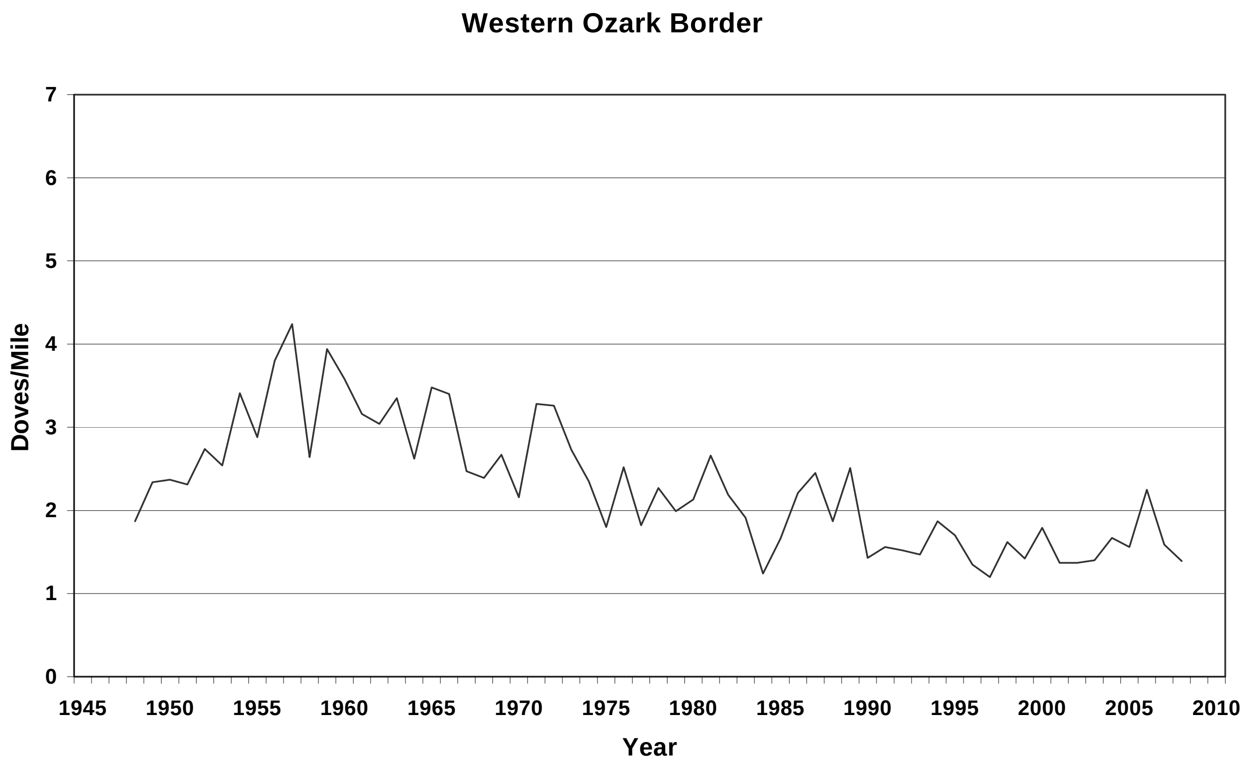


Figure 14. Western Ozark Border Zoogeographic Region.

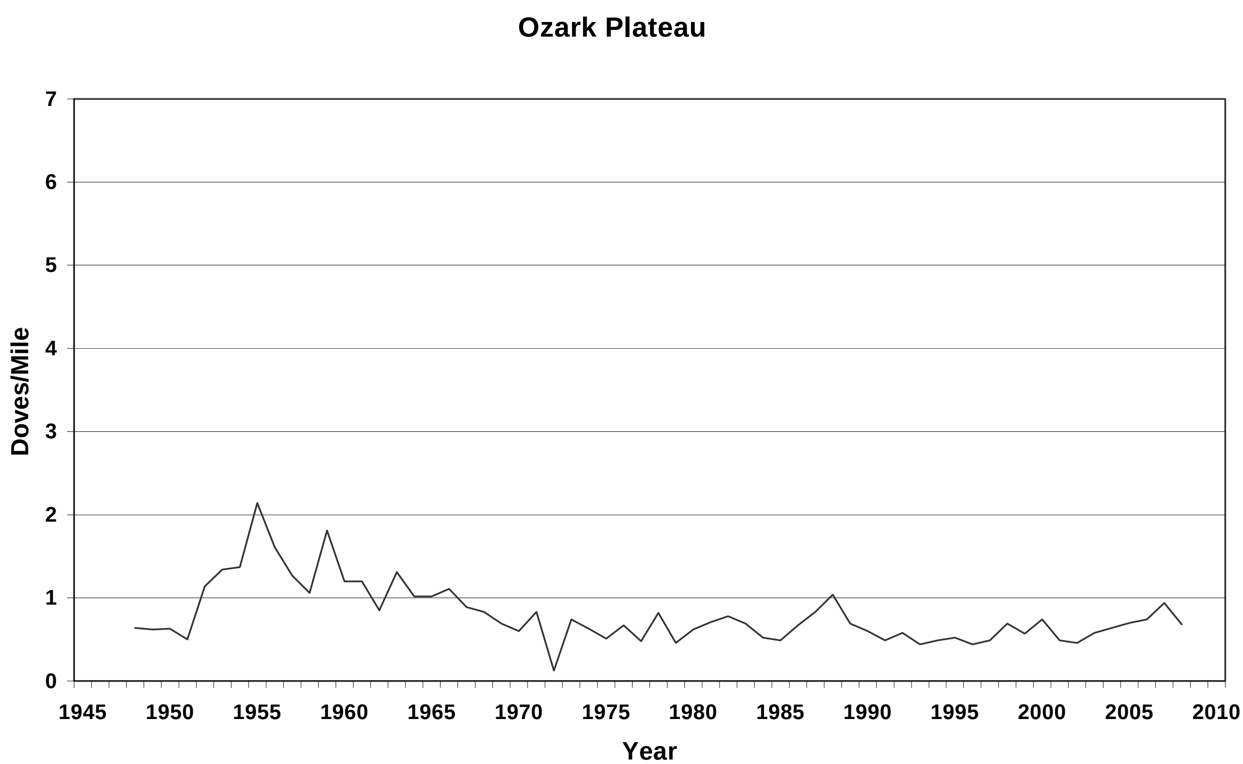


Figure 15. Ozark Plateau Zoogeographic Region.

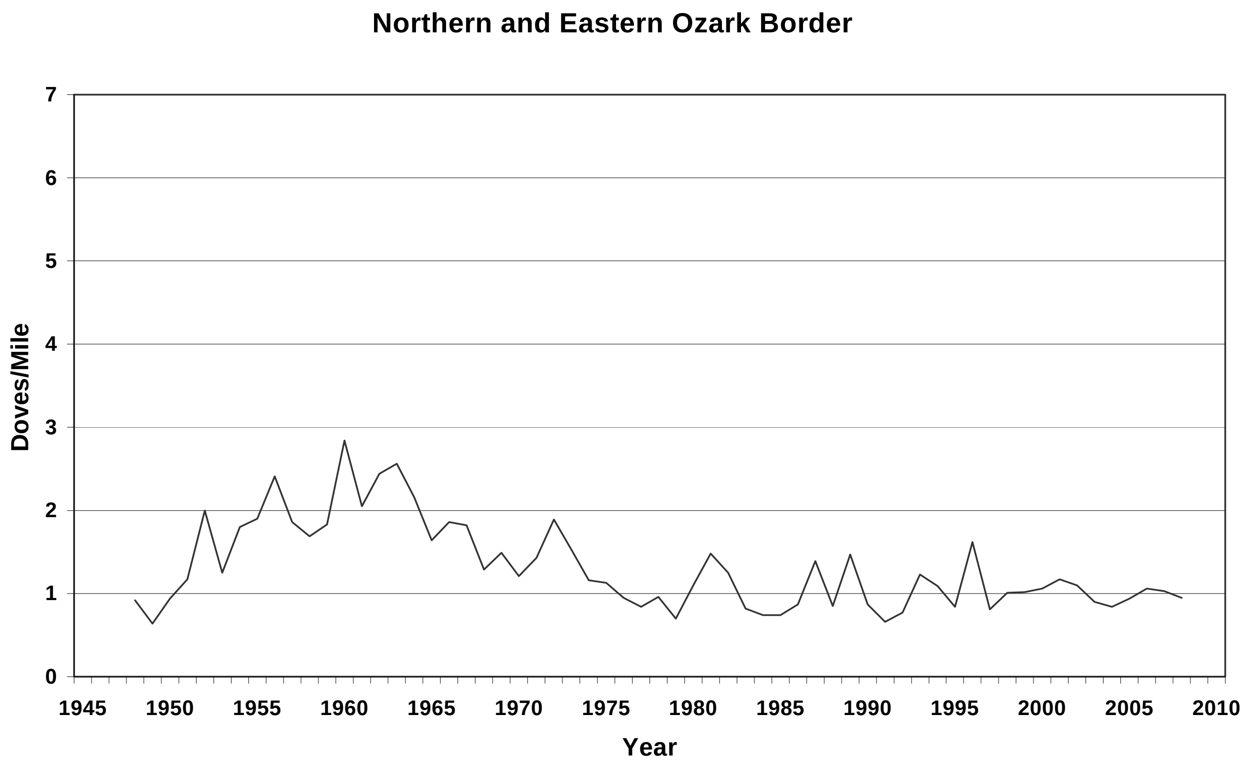


Figure 16. Northern and Eastern Ozark Border Zoogeographic Region.

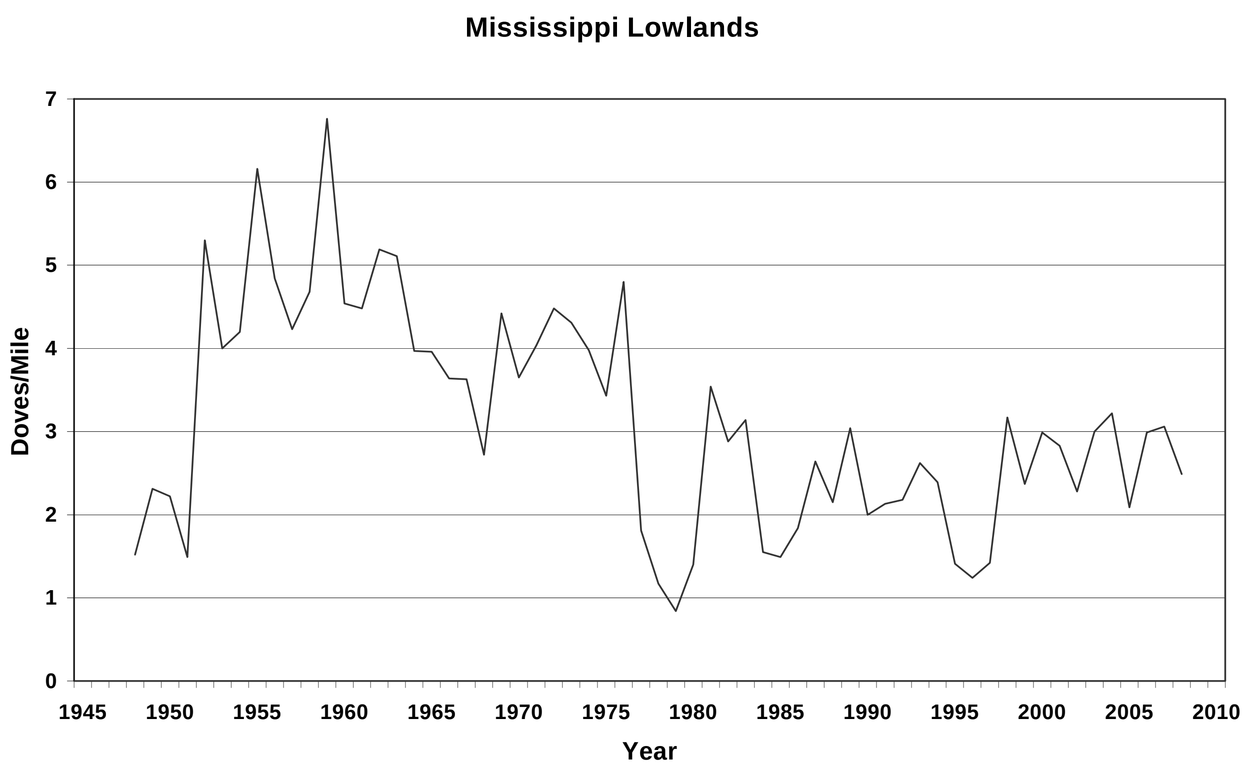
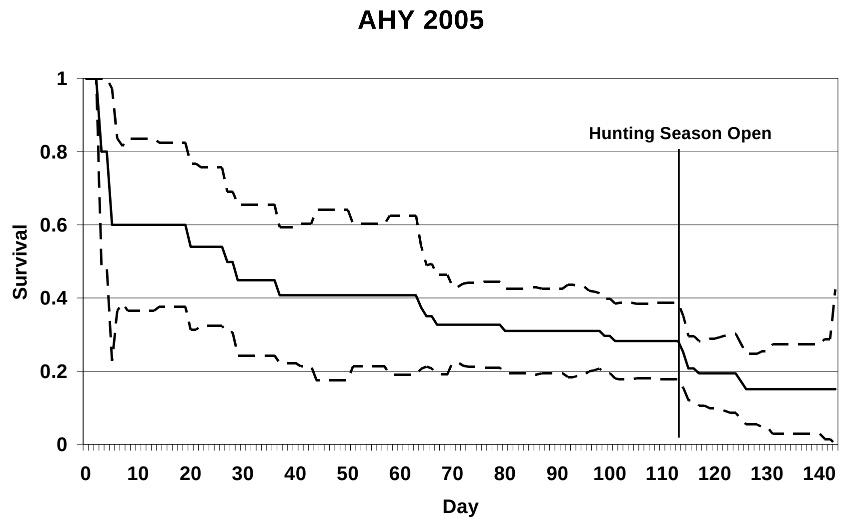
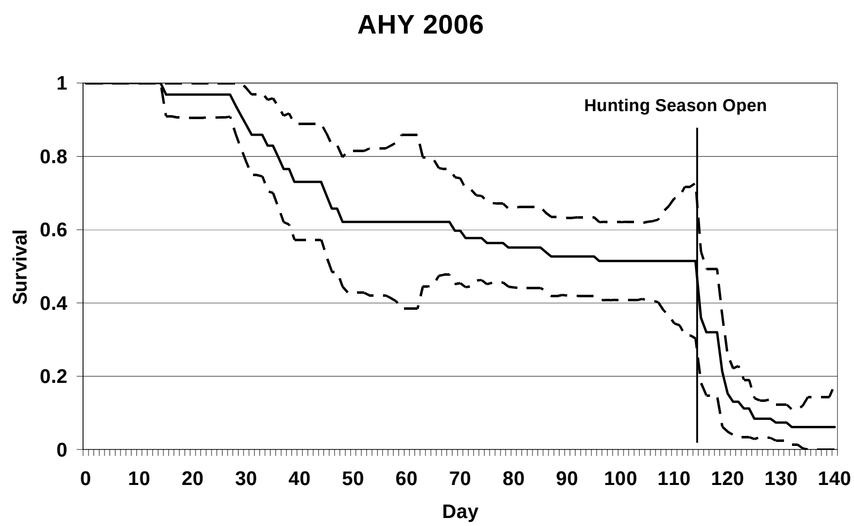


Figure 17. Mississippi Lowlands Zoogeographic Region.





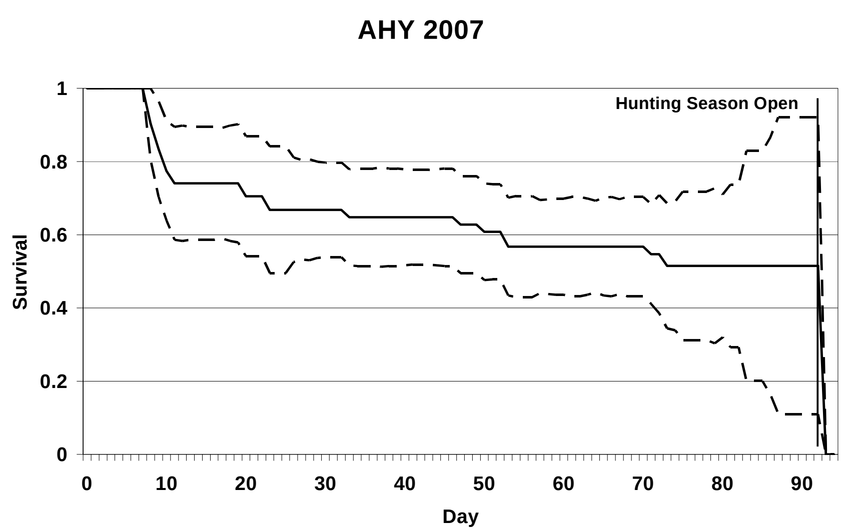


Figure 18. Survival distributions (Kaplan–Meier product limit estimator with staggered entry) for after hatching-year (AHY) mourning doves during 2005–2007 on the James A. Reed Memorial Wildlife Area.

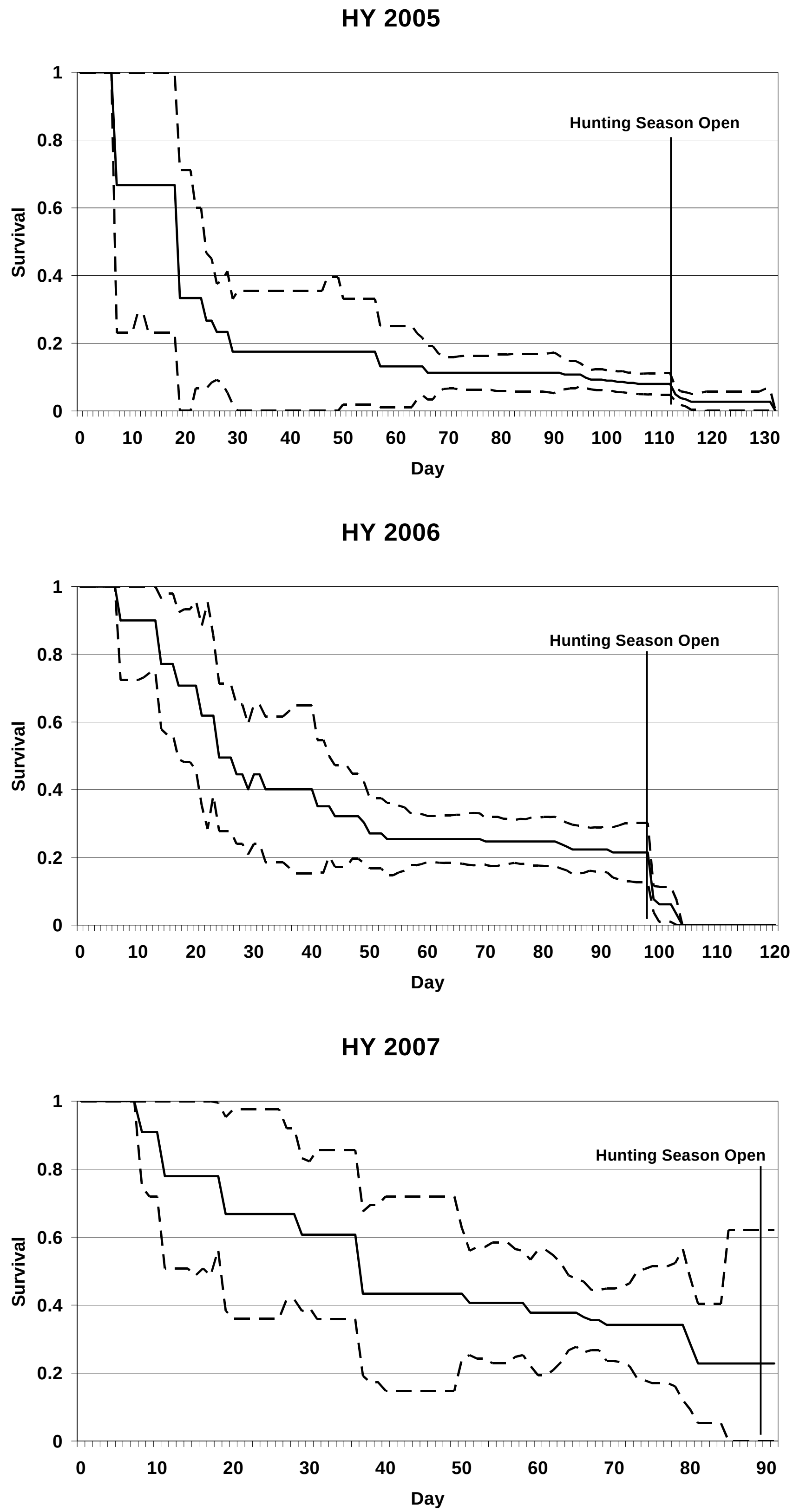


Figure 19. Survival distributions (Kaplan–Meier product limit estimator with staggered entry) for hatching-year (HY) mourning doves during 2005–2007 on the James A. Reed Memorial Wildlife Area.